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Electricity and Water Supplies

THE break in the drought of the last two years should not allow us to forget its lessons. The more obvious precautions will, no doubt, be taken to protect the larger centres of population from a water shortage that may never occur again in our time, but what we have to bear in mind is that there are quite six million people in this country who are always without adequate supplies of pure water, and that their plight is only emphasised and brought to public notice by a drought.

The recently issued second report of the British Association Committee appointed to inquire into the position of inland water survey strongly recommends that the Department of Scientific and Industrial Research should be responsible for the systematic collection, collation and technical direction of water measurement, and that it should keep records of resources comparable with those which are already obtained for rainfall.

In this it gives specific form to a general recommendation of the Water Power Resources Committee of 1921, but at that time the electrical aspect appeared to be mainly one of estimating the potentialities of hydro-electricity and the needs of condensing water for steam power-stations. While we can now place the former at about 320,000 kW, we still require information regarding the corrosive and other effects of river water used for condensing, but our main concern at present is with the provision of potable water.

The annual report of the Electricity Commissioners (reviewed by us last week) referred to the consideration being given to this subject by the Conference on Electricity Supply in Rural Areas, and a report issued by E.D.A. last summer contained a wealth of technical data derived from working experience.

The question arises as to whether isolated districts should be supplied by extending the water mains of large towns or from small local pumping-stations. Dr. A. Parker, of the Department of Scientific and Industrial Research, addressing the Yorkshire Section of the Society of Chemical Industry, appeared to advocate the former, on account of the risk of contamination of surface water which might be near sources of pollution.

This aspect is connected with sewage disposal, which is also dealt with in the E.D.A. report, but the public mind should be set at rest on this point by the presentation of authoritative information regarding simple and cheap means (preferably electrical) of ensuring that local water shall at all times be free from undesirable bacteriological and chemical properties.

Given equal quality, the parallel between an electric and water grid cannot be drawn very far—on its economic side the analogy is rather one of the difference in cost between transmitting electricity and transporting coal. The same considerations of relative efficiencies do not arise, and small pumping stations, being automatically controlled, permit attendants to be dispensed with.

Generally speaking, they would appear to provide the better method of meeting the public need, quite apart from their value in furnishing a nucleus load for rural electrification schemes which are thus enabled to become economically feasible at an earlier date than would otherwise be the case.

Illumination Schemes for May

OUR public lighting and illumination experts and the manufacturing and trading concerns which are identified with this branch of electrical activity will be well advised to prepare for great doings in connection with the celebration of the Royal Jubilee in May. Some of our older readers will have very vivid recollection of the spirit of rivalry that existed between different communities all over the country to produce the most original and beautiful effects, at two Coronations and King George's Wedding. In those days electricity supply undertakings were small, but they scored great successes in painting their towns with colour and light, and tramcars were illuminated. The electrical material available was much of it primitive and costly compared to the variety, novelty, and cheapness of the means procurable to-day. Even normal efforts at illuminating effects

are on a substantial scale now, but in May next, according to the indications, something far beyond the normal may be expected all over the country, however late the official lighting-up times may be. The proposal that has been advanced by private traders for the floodlighting of Regent Street buildings indicates that business concerns there show no disposition to stint in this sort of preparation for the celebrations. That the traders' association is taking a large and a long view is obvious from the correspondence that has passed between it and the Westminster City Council. It contemplates a three years' contract for floodlighting from 5.30 p.m., or lighting-up time, to midnight each night except Sundays. There is opposition which raises the question of the legality of placing standards on the pavement, but the recognition that a Great Way of Light will be a profitable trade investment is a thing to note.

Meters and Time Switches

UNTIL such time as electricity is supplied as water is, on an all-in periodical rate, the meter will remain an essential part of every installation. We think that it is not always realised how big the meter business is. Every new consumer has to have at least one meter, and about half a million people come on to the mains every year. Then, like human beings, meters wear out or become obsolete and have to make room for new ones; again, change overs of systems necessitate replacements. Thus we should expect meter makers to form a very prosperous section of the industry, and we should judge from their reports that they are fairly satisfied. They are also very active, however, as will be seen from our review of recent developments; they are ready to meet each new requirement as it arises from the tariffs of various kinds which supply engineers devise. Time switches, too, are now available to meet widely varying programmes, and these also are reviewed in an article in this issue which resulted from interviews with manufacturers.

Diesel-Electric Shunting

IN writing of the prospects of the oil-electric system of traction just over a year ago we referred to the field presented by shunting. The L.M. & S. Railway Co. is so pleased with the result of seven months' extended trial of a 300-h.p. Diesel-electric locomotive that it has ordered ten more of the same type from the English Electric Co. and ten from Sir W. G. Armstrong Whitworth & Co. for duties in busy yards up to twenty-four hours a day for six days a week. The reduction of maintenance costs due to easy starting by push-button and smooth acceleration, combined with the simplicity of the one-man control, has no doubt considerably influenced this decision. A consumption of two to three gallons of fuel oil and 0.65 pints of lubricating oil per engine hour is a very reasonable figure, and we can confidently anticipate that the system will be extended for this class of work as well as for passenger service on branch lines with low traffic densities.

Telephone Development

FEW appointments could be more appropriate, or more generally approved in the electrical industry, than the selection of Mr. Frank Gill as chairman of the Telephone Development Association. Throughout his lengthy and successful career he has been conspicuous for his expert knowledge of telephony, both in this country and internationally. His presidential address to the Institution of Electrical Enginers in 1922, and his subsequent paper on international telephony read before the same body, still hold their place as remarkable treatises on the subject. In recent years he has devoted himself to the problems of telephonic communication in many countries near and far, and in addition he holds the chairmanship of Standard Telephones & Cables, Ltd., and various related companies. It is very fitting that one so highly qualified, and one who has always led the way in enterprising thought and policy, should preside over the T.D.A. at a time when facility of telephonic speech is recognised as one of the greatest necessities between us all at home and with the whole human race overseas. In co-operation with a Postmaster-General who is so heartily in accord with a department of State which is eager to make progress, the movement will grow apace, and one indication, among many, of coming advance is the forecast of several millions outlay upon new underground telephone cables in the United Kingdom.

A Shorter Working Week

READERS who are thinking deeply regarding the great problem of unemployment, and especially those who find difficulty in making up their minds regarding the effects that shorter working hours would have upon industry, will find a letter in our "Correspondence" section to-day which may well form the basis of an interesting discussion. As is well known, the subject of shorter hours without reduction of pay has exercised both the Amalgamated Engineering Union and the Engineering Employers' Federation, and the latter have expressed themselves against it. But it is also known that Mr. Oliver Stanley, the Minister of Labour, has stated that the problem is under close consideration with reference to certain industries. The writer of the letter to which we refer states a case for change in connection with the electricity supply industry. It would be interesting to hear what the E.P.E.A., the I.M.E.A., and some of the other responsible authorities have to say on the subject.

Confound Their Politics!

AN editorial in a Dewsbury newspaper announces that gas is replacing electricity for street lighting all over the country. The facts are that the percentage increase in the number of electric posts is more than two-thirds greater than that for gas, and the difference is likely to be considerably improved upon with the success of discharge lamps, which have recently replaced 3½ miles of gas lamps in Birmingham—a stronghold of our competitor. There has been a net gain of over 500 miles to electricity from such conversions, and we have a list of well over 200 areas in which the public lighting is all-electric, including Hove, where 2,774 lamps were recently changed over. There is good reason to believe that, in most of the few instances in which the opposite has happened, local considerations, including politics (in Dewsbury some people fear that electricity from a profit-making company may supersede the municipal gas installation) have been permitted to influence the situation unduly. If local lighting committees were composed of those without bias in favour of any particular form of illuminant, we should certainly have nothing to lose by it.

Hot Water

THE effective demonstration of electric water heating may present difficulties, but we have faith enough in our showroom experts to believe that these will be overcome. Many minds have been exercised with the problem of showing that the water really is hot without obscuring the windows with clouds of steam, that it is always available, and that the fact that it is always ready makes the electricity bill reasonably low. A number of display suggestions are brought together in an article appearing on page 25 of this issue, and we shall be glad to receive particulars of any practical proposals which are in use but are not there included. We believe that E.D.A. has on sale an inexpensive illuminated box sign in which its yellow-and-green hot-water poster is lighted up in such a way that the water is made to appear to bubble and flow. The box contains a couple of lamps which light the poster, and their heat drives a revolving cylinder which, without going into further details, produces the effect. There is plenty of room for the exercise of ingenuity in such directions.

Modern Electricity Meters

A good selection for all purposes

As the result of visits to and conversations with the leading manufacturers we are able to indicate in a broad manner the tendencies in the design of electricity meters—a subject of prime importance to electricity supply undertakings as well as to their consumers. It will be judged that finality and uniformity are not yet in sight and there still exists ample scope for the exercise of ingenuity and resource in this direction.

ALTHOUGH it seems that practically all meters are now made to British Standard Specification, there are many expressions of individuality among the various makes. One trend is the progressive reduction in overall size.

In the showrooms of Messrs. Robert Hornby & Co., Ltd. (Siemens-Schuckert) we saw 1898 and 1934 models of the same capacity and type of meter. The older one weighs 15¼ lb. and the other 2¾ lb. Equipment produced by Messrs. Ferranti, Ltd., shows how this trend has affected design both electrically and mechanically. All the parts are assembled within the smallest square which will contain the rotor, and all holes which would reduce the section of material have been avoided. In the company's three-phase meter the driving units all operate on a single disc, and interference between them through the disc is prevented by constructing the disc with the centre portion of glass. Mr. East of British Sangamo Co., Ltd., informs us that his company is guarding against making meters too small lest the components should be inaccessible.

There is at the moment something of a controversy over electrical sizes, for the low-load and high-load characteristics of the modern domestic installation has led to the introduction of "overload" meters which will register accurately on, say, 40 W or less, and also on 4 kW or even more. Major R. Amberton (Electrical Apparatus Co., Ltd., at the time of our interview) said that most engineers agreed that the number of B.S.S. sizes should be reduced in the interests of manufacturing efficiency, and to simplify stocking. The I.M.E.A. had suggested three sizes only—5, 20 and 50 A—and another school of thought suggested 10, 25 and 50 A. The present-day 10-A meter dealt accurately with the lightest loads and permitted a fair amount of domestic heating and cooking, and as it was good for over 20 A it was more logical for the next size to be 25 A. Probably everyone would be satisfied with 5-, 10-, 25- and 50-A meters.

Venner prepayment meter with infinitely variable fixed charge collector

Most manufacturers agreed that there was not much, if any, point, at any rate technically, in regarding what was intended to be a normal, safe and continuous load as overload. It appears to be a safe conclusion that the "overload" meter is an example of what happens when market conditions get ahead of existing B.S.S. requirements. But a new Specification is on the way, we believe, and if it clarifies the position several manufacturers will be pleased.

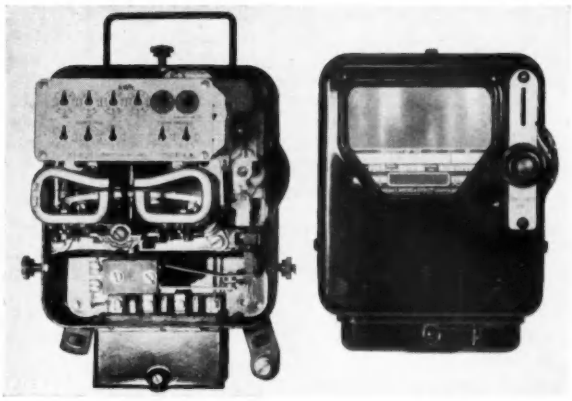
The "long range" meter recently introduced by Siemens Electric Lamps & Supplies, Ltd., no doubt reflects Mr. Kullman's distaste for the term "overload." He said that the important constructional changes in the "long range" meter were much more iron in the shunt and series circuits, stronger brake magnets, and the reduction of the "full-load" speed to 20 r.p.m., so that it would not run too fast on "overload." There was still a call, he said, for the older rating with 25 per cent. actual overload.

The all-insulated meter is now getting a strong hold. About 90 per cent. of the Sangamo production of s.p. meters is now in bakelite. Mr. Hill, of Aron Electricity Meter, Ltd., referred to the bakelite meter as becoming fashionable. But it had very definite advantages; it was shockproof and it overcame earthing difficulties.

The Metropolitan-Vickers Electrical Co., Ltd., emphasised the reduced clearances in the all-insulated meter—another help in the reduction of overall dimensions. Mr. Wilson (British Insulated Cables, Ltd.), stressed the improvement in appearance effected by bakelite.

Messrs. Chamberlain & Hookham, Ltd., seem to have approached the bakelite problem very cautiously. They have avoided threads actually in the material, for fear of stripping, and they use metal nuts, but not moulded in. An important advantage of bakelite was that it never wanted painting, said Mr. Carter.

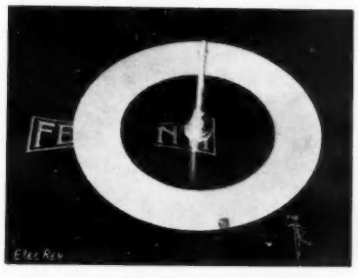
The "Rex" meter (Messrs. Thompson & Co.) is still produced in cast-iron only, because that is favoured in manufacturing centres. But it is a comparatively light base, providing solid fixing for the elements, and with thick pressed-steel cover it makes a robust combination. Mr. Hornby said that all sheet-steel construction possessed the same rigidity as cast-iron, but was lighter. British Electric Meters, Ltd., treat their meter cases with a special chemical deposit which overcomes trouble due to pieces of nickel chipping off and adhering to the brake magnets.



Landis & Gyr prepayment meter; switch at bottom

The introduction of bakelite and sheet-steel cases has rendered possible the separate self-contained electrical unit or meter proper (independent of the case) which eliminates aligning difficulties. But at least one company does not advocate going so far as to include the terminal block. B. E. Meters say the gasket around the block is not a success, because such a good fit as that of the cover cannot be obtained. Their meter proper, by the way, is in two portions—electrical, and rotor and register—each with its own frame. The two frames engage by dowels and it is simple to lift out the rotor unit only. Siemens are proud of their one-piece frame; rigidity is ensured by welding at two points.

The bottom bearing of the meters produced by Measurement, Ltd., has a sapphire mounted on a spring contained in a jewel barrel covered by a screw cap. The position of the jewel in the frame is automatically fixed, and the barrel is held in position on the frame by a spring. No tools are required for removing or replacing the bearing and its components, and this feature applies to all parts of the meter. The spring-loaded bottom bearing of the "Elgee" meter produced by Messrs. Landis & Gyr, Ltd., consists of an inverted jewel rotating on a spherical steel pivot mounted rigidly in a brass setting. Any dust that finds its way in falls directly to the bottom of the pivot chamber.



Glass-centre disc for 3-phase Ferranti meter

The pivot of the "Rex" meter is easily removable from the spindle, and it can be renewed for 3d. The main or lower bearing of the new meter produced by the English Electric Co., Ltd., is "pivotless." It comprises a small, polished and hardened-steel ball, running between two natural sapphires. The rolling action imparted to the ball by the revolution of the rotor shaft reduces friction to a minimum.

Probably most modern meter developments are in connection with prepayment meters. Again, in the Ferranti meter we saw a means of making the equipment smaller. The switch has very heavy butt contacts, and very quick break through a double-toggle action, and a gap so small (1/100th in.) as not to permit ionisation and hence arcing.

The C. & H. equipment is the only three-phase prepayment meter that we saw. It is ready for the three-phase cooker. Three s.p. mercury switches are employed. The mechanism operates one of these, and this is lever connected

to those on the other poles. Messrs. Thompson have changed over to mechanical tripping, and they state that there is no more friction than with the electrical method.

The British Sangamo Co., Ltd., says that some undertakings have reported as much as 20 per cent. revenue increase from prepayment consumers as the result of installing multi-coin meters. This company's meter was the only one which we saw that will take three coins—1d., 6d. and 1s. Smith Meters, Ltd., showed us their latest production, a prepayment meter which embodies both the variable-tariff principle and multi-coin mechanism. The variable-tariff mechanism is of the "universal" type, which can be adjusted in very small steps without the necessity of removing the meter cover.

B.E. Meters, who have introduced "universal" gear meters and are developing one combined with the multi-coin feature, said that there was still a demand for the change-wheel system, but the "universal" would gain favour because the tendency was to reduce tariffs in small percentages; for low tariffs a farthing reduction was very large. To ensure that the meter man releases the clamping for the prevention of coinage loss when he changes a compound, Ferranti's have provided for a projection which prevents the cover from being put on until the clamping is released. A new M.V. universal price-change meter embodies mechanism by which the price can be varied over a wide range by turning a graduated disc.

The success of the small synchronous motor has played an important part in the development of the two-part tariff or rent-collector meter in which the constantly operating motor runs off time in terms of any desired rate—winding shillings away or making up arrears. Sangamo provide three-rate steps—½d. to 1s. 10½d., 1d. to 3s. 9d. and 2d. to 7s. 6d. The middle one seems to suit most customers. C. & H. make a point that with their two-part tariff meter some electricity can always be obtained for the first coin inserted, irrespective of the arrears.

Because of its favourable influence on hire-purchase business, the Electrical Apparatus Co. advocates the easy adjustment of the fixed charge as well. In the Ferranti fixed-charge meter the charge is variable by altering the length of a worm gearing between the synchronous motor and the differential, thereby introducing variable idle time. In the Venner meter of this type the fixed-charge collector can be adjusted externally in infinitely variable steps.

Then there is the fixed-charge or rent collector as distinct from the meter, but which can generally be used in conjunction with the meter to give equivalent results. Venner's infinitely variable method is also now applicable to their standard a.c. rent collector. Instant adjustment is claimed for the L. & G. fixed-charge device, which may be fitted to the prepayment meter referred to. The time-keeping device embodied in M.V. fixed-charge collectors is now, in some instances, a form of synchronous motor.

In the Measurement "two-rate" meter the graduated fixed-charge adjustment scale is coupled mechanically with a catch, which is released after the meter has registered the predetermined number of units at the high rate. The release of the catch causes one pair of wheels (high rate) to disengage and another pair (low rate) to engage. By pulling a ring which is made accessible when the coin box is removed the change-wheel rocker is operated so as to engage the high-rate wheels. By a special counter on the L. & G. two-rate meter consumption is registered separately on one or other of two rows of figures, according to whether the high or low rate is in force.

The D.C. Meter

While all interested manufacturers reported a decline in d.c. meter business, Messrs. Fox & Offord, Ltd., told us that there had been brisk business recently in repair work. While the electrolytic meter is now almost in the historical class, the Reason Manufacturing Co., Ltd., claims that it is still the most sensitive of all commercial meters. Although it is an Ah meter only, with constant voltage, it is suitable for metering on a kVAh basis. Mr. Willis said he thought that method would be the one of the future. By means of a suitable rectifier unit which the company has now developed these meters are to be suitable for a.c. work also. But the company seemed rather more interested perhaps in demand indication, and Mr. Jones said that because many undertakings nowadays paid for their bulk supplies on a maximum-demand basis it was logical that they should charge their consumers by the same method. They had recently introduced a small s.p. indicator suitable for domestic loads up to 25 A, and also a three-phase unit which was made suitable for a.c. work by the use of three s.p. rectifiers. The indicators operated on the thermal principle, so that the s.p. unit could be used direct on a.c.

Time Switch Progress

THE development of the synchronous motor has opened up a big field for time-switch control work in connection with manufacturing processes by virtue of the relatively unlimited power available. The clock spring expends practically all its energy in driving the gear, said Mr. Drew, of Messrs. Everett Edgcumbe & Co., Ltd., so that there is no reserve for outside work.

But success is not wholly dependent on the synchronous, or indeed, on the asynchronous motor, and, as Mr. Brooks, of Messrs. Robert Hornby & Co., Ltd., said, much depends on the accuracy of control required. The synchronous-motor movement was generally cheaper for precision work, such as the control of meters, but for shop-window lighting, say, 15 min. delay or advance would not have serious consequences.

A good example of apparatus for process control is the Salford constant-time relay produced by the General Electric Co., Ltd. It provides a time delay between switching operations such as is required in controlling the switching of the h.v. supply to a thermionic valve, so that the cathode is heated before the h.v. is applied. An electromagnet is excited by two coils which are connected in series with the controlling relay. When the coils are energised a special armature is revolved which winds a spring and sets in motion clockwork that regulates the timing.

There is a range of Everett Edgcumbe "Synclock" process switches with synchronous motors, for industrial controls where the actual time of the day is not important, but the control of definite time periods is critical. One unit is designed to control an electric furnace, and is so arranged that after a predetermined adjustable time interval from switching on the main current by hand a resistance is introduced in the furnace circuit, so as to allow it to cool down slowly, and after a further interval the furnace is switched off altogether.

In its simplest form the "Synclock" programme switch provides for an adjustable programme over 24 hours. Signals can be given at any 5-min. point, and the number of successive signals is unlimited, except for the minimum interval. A day cut-out is provided so that signals can be omitted on certain days. In another programme switch of the same make one signal follows another at an interval as short as one minute. The settings are made on a series of drums.

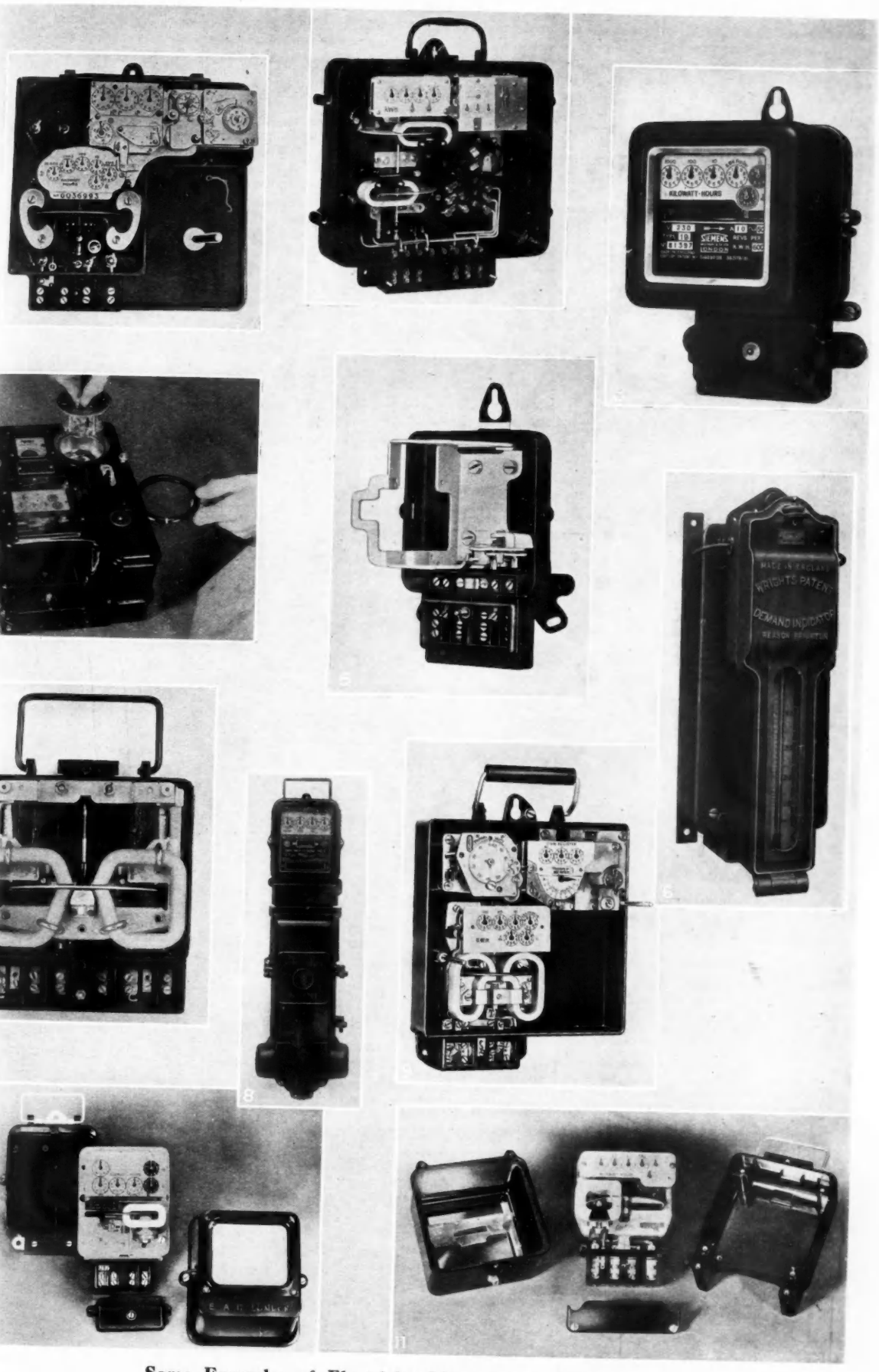
Messrs. Nathan & Allen, Ltd., showed us a programme switch fitted with a 6-in. seven-day dial. The periphery is divided into seven 24-hr. sections, each of which can be fitted with up to six "on" and six "off" arms which can be set so as to provide a different programme for each day of the week. To miss a day it is only necessary to take the arms off. The switch can be supplied in a relay clock or in a power time switch for any current up to 600 A. The minimum between "on" and "off" on the relay switch is one hour and on the power switch 1¾ hours.

Similarly, on the 24-hour dial switch introduced by the British Sangamo Co., Ltd., there are several pairs of arms which can be easily adjusted to almost any position. The switch can be blocked to prevent closing on any selected days of the week by means of stops which can be fitted to the required spokes (selected days) on an adjacent week wheel.

Closely allied with the process switch is the time-lag equipment which is intended to replace an ordinary tumbler switch and to provide automatic switching off after a predetermined short time, an adjustable dash-pot providing the delay action. The G.E.C. "Corridor" switch will handle 3 A at 250 V. There are two "Columbus" automatic time-lag switches, sold by the Elkay Electrical Manufacturing Co., Ltd., one of which can, at will, be used for making permanent contact.

Many meter manufacturers have recently entered the time-switch field, probably because the time switch is now increasingly used for metering, and because the synchronous motor adopted in many cases for fixed-charge collector meters is particularly suitable for time-switch driving. The Sangamo time switch motor, for instance, is the one developed from the company's fixed-charge collector meter.

Messrs. Chamberlain & Hookham, Ltd., have developed a small and compact time switch particularly for use in conjunction with demand indicators, and in connection with their hand and electric wound units British Electric Meters, Ltd., refer *inter alia*, to two-rate metering systems. Messrs. Ferranti, Ltd., are developing a comprehensive range of time



Some Examples of Electricity Meters now Available

1. Sangamo model with fixed-charge collector. 2. C. & H. three-phase slot pattern with mercury switches. 3. A long-range meter. 4. "Outside" adjustment for universal variable tariff (B.E.M.) 5. One-piece element fixing frame (Siemens). 6. Reason domestic-model demand indicator. 7. Ferranti single-disc three-phase meter. 8. B.I. combined meter and service cut-out. 9. Met.-Vick. step-rate equipment. 10. E.A.C. self-contained meter withdrawn from case. 11. Dis-assembled Aron unit; meter proper complete with terminal block

switches, the first of which to come into full production is one for maximum-demand work. They have produced a self-starting synchronous motor, 200 r.p.m. It has a highly magnetised permanent-magnet rotor with six poles out of balance. This causes oscillation on switching on, and when the oscillations become large enough the rotor starts and pulls into step.

The Nathan & Allen synchronous motor runs at 3,000 r.p.m., and we were told that this enables simple field-coil adjustments to be made for different voltages. Messrs. Robert Hornby have a time switch with an asynchronous motor. The torques of the motor and the spring are in opposition, and the motor is connected to the supply continuously, so that the clock is kept wound up. There is thirty-six hours reserve in the spring.

Venner Time Switches, Ltd., report that their principal achievement in the past few months has been a synchronous time switch, also with thirty-six hours' spring storage. They point out that although the Venner motor is self starting, in the event of a stoppage the straight unit is rendered slow by the duration of the failure. In the new switch the usual train of wheels is governed by an escapement and drives a 24-hour spindle. The main spring is wound by the motor, which also drives a synchronising gear, which sets the clock to true time every 62½ minutes. The synchronising gear engages a 24-tooth star wheel in the train. The train and escapement gear is continuously running to prevent gumming up. One hears objections to the synchronous motor on account of noise, but Sangamo claim to have obviated this by bakelite gearing.

There is, we believe, still some controversy as to unit *versus* group control of public lighting. The Horstmann Gear Company, Ltd., says that the cost of unit control is usually lower than that of group control, while the failure of one unit is confined to one lamp. Of the range of "Newbridge" equipment available they recommend the solar compensating dial equipment with 40- to 42-day or electrically wound clocks for unit control as the most ecomonical proposition. The solar compensating dial allows for the "flat spots" of June and December in the solar curve, and standard cams provide for variations from ½ to ¾ hour "lags" between sunset and lighting and extinguishing and sunset times, because twilight and dawn last longer in summer. Dials with special cams can be supplied to suit any conditions. While not strictly a time switch the "Radiovisor" public lighting control unit is of interest in this connection.

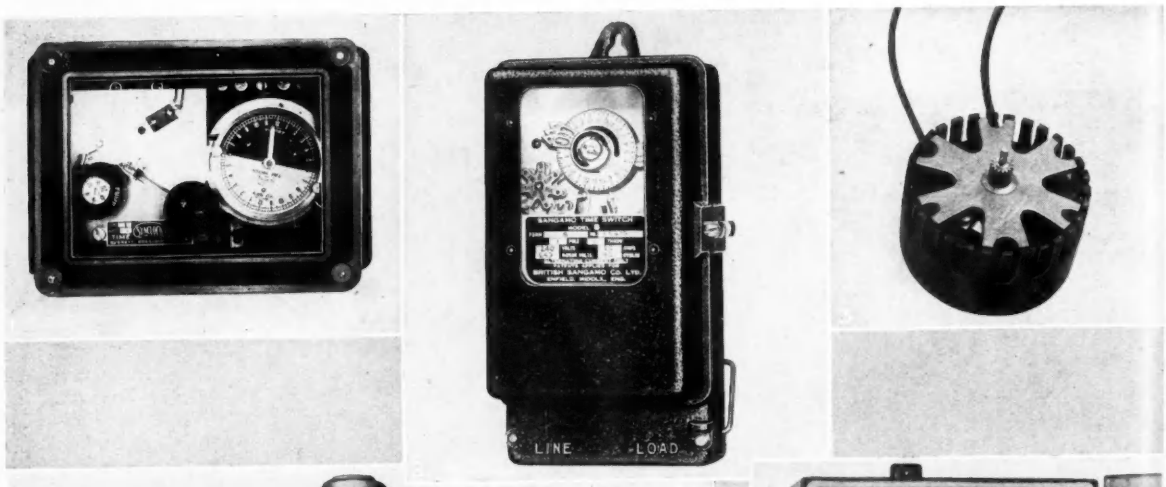
A recently introduced equipment specially for public lighting control has a box arranged for spigot mounting with two doors, one giving access to the clock, and the other to the separate fuse chamber. Among the Ferranti equipment being developed we saw some in watertight and pole-mounting cases, and also an example of a tendency among meter manufacturers to put time switches in meter cases. The one example of a bakelite case which we saw was the Stanley unit.

We saw evidence of a leaning towards metal-to-metal contacts with minute breaks. Sangamo showed us heavy silvered contacts operated by a roller toggle arm over an exceedingly short gap, and they told us that tests have proved eminently satisfactory. Ferranti's have something similar in which the heavy silvered contacts under high pressure could only possibly draw an arc of twenty mils. In their maximum-demand switch, however, scissors-type contacts are employed.

In the time switches produced by the Reason Manufacturing Co., Ltd., we saw examples of the company's mercury-tube products. They said that with carbon-to-carbon, or metal-to-metal contacts arcing was inevitable, and sooner or later they would require attention. There was also a likelihood of oxidation. With the mercury tube these troubles were eliminated and less operating power was required.

Stanley Electrical told us that in their most recent introduction they have made, by means of a mercury tube, a 25-A unit with overall dimensions only slightly above those of a 5-A switch.

A novelty is the "Sandy" synchronous clock and time switch introduced by Messrs. Wm. Sanders & Co. The clock is intended for use actually as a timepiece, and the switch will take a loading of 3 kW. It is intended mainly for domestic use, such as controlling a fire in a bedroom or a kettle.



Time Switches and their Applications

1. "Synclock" process switch for furnace control. 2. The new Sangamo time switch. 3. Ferranti self-starting synchronous motor. 4. Radiovisor valveless light-sensitive public-lighting control unit. 5. Six-inch 7-day programme switch (N. & A.)

Modern Instrument Design

New electrical devices shown at the Physical Society's Exhibition

There were few concerns represented at the Physical Society's twenty-fifth exhibition (Imperial College of Science and Technology, January 1st, 2nd, and 3rd) which did not record some interesting development during the past year. Examples of improved design abounded among electrical measuring, indicating and recording instruments, noteworthy being the new illumination meters and applications of rectifiers. There were also a number of novel exhibits, including one for indicating whether hunting by scent on a particular day is likely to prove successful. In the following pages we give a brief review of the principal exhibits of electrical interest.

Automatic Coil Winder & Electrical Equipment Co., Ltd.

Macadie automatic machines for winding coils with multilayers are supplied, as well as "Avometer" instruments of several sizes and patterns for comprehensive d.c. and a.c. testing purposes, with an adaptor for testing all kinds of radio valves.

Baird & Tatlock (London), Ltd.

A non-battery type of dry photo-electric cell and constant light flux are employed in a hæmoglobinometer for testing blood. For measuring the specific gravity of liquids Dr. L. A. Bishop has designed a soft-iron float which is attracted by a coil; the current in the coil which attracts the float magnetically is a measure of the specific gravity. Dr. Burrows Moore has designed a conductivity cell with special electrodes for quick measurement without frequent calibration. A chart of the electronic configuration of the elements, high-speed electric centrifuges, and electrically heated baths which are automatically disconnected should the water supply fail were other exhibits.

Bakelite, Ltd.

Examples of synthetic resin products and finished mouldings included varnishes, cements, lacquers, laminated sheets, rods and tubes, and silent gear material.

British Electric Resistance Co., Ltd.

The display of this concern included portable Wheatstone bridges fitted with a self-contained galvanometer and with selector switches completely enclosed in bakelite dustproof covers; laboratory type resistances with patent self-lubricating copper graphite contacts and new slider boxes; oil-immersed, wire-wound resistances for working voltages up to 100 kV; various types of air-cooled resistances suitable for X-ray and electro-medical apparatus in values up to 1 megohm. Portable flash testing apparatus is made with a range of 1,000-10,000 V in ten steps, fitted with resistance voltmeter control and automatic overload protection. There is an extensive range of double-wound, air-cooled shell type transformers for commercial voltages and frequencies (50 VA upwards to 2.5 kVA) non-inductive ratio coils, dial pattern resistance boxes, vitreous enamelled resistances and embedded wire-wound resistances with new mountings.

Cambridge Instrument Co., Ltd.

In the design of a new dynamometer a magnetic circuit of high-grade nickel-iron alloy (suggested by Dr. C. V. Drysdale) is used to reduce the losses and to increase the electromagnetic efficiency. The movement is self-screened.

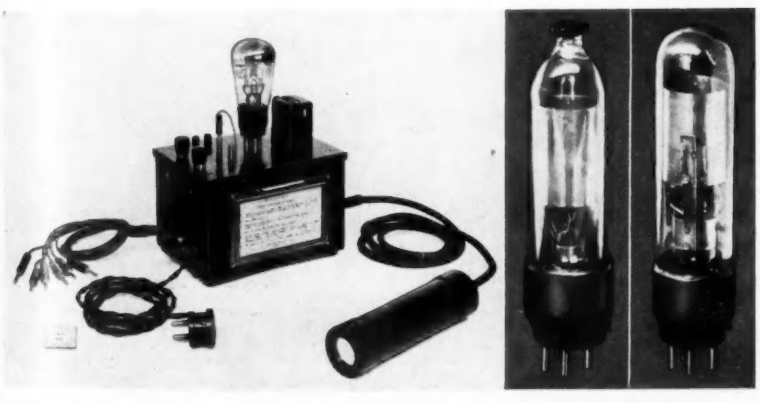
The megohmmeter recently developed by Mr. L. B. Turner, of the Engineering Laboratory, Cambridge University, is a dual-purpose self-contained instrument capable of measuring from 0.1 to 10,000 megohms, and alternating voltages from 0.1 to 3. By the addition of an 80-V battery in series with the resistance under test the range may be extended to 100,000 megohms. A capacity meter is available which is useful in routine limit testing and may be operated directly from the a.c. supply, the pressure on the condenser under test never exceeding 100V. Variations of 20 per cent. in supply voltage will not affect the meter's accuracy by more than 0.3 per cent.

A portable, self-contained and direct reading electrolytic bridge has been developed which is capable of measuring the resistance or conductivity of electrolytes from distilled water to strong salt solutions. The Cambridge universal bridge measures d.c. resistance from 10^{-4} to 1.11×10^{6} ohms self-inductance from 0 to 100 henries, mutual inductance from 0 to $\pm$ 11.100 microhenries, frequency from 400 to 10,000 cycles, and capacitance from 0 to 11.1 microfarads. The bridge is direct-reading except for frequency, in which case a table is provided. It is simple to use and accurate enough for all routine measurements.

A modern three-element oscillograph embodying the latest modifications was shown working in conjunction with an amplifier to obtain records from very feeble sources. The Finch type cathode-ray oscillograph, also exhibited, is suitable for recording transient phenomena, such as occur on transmission lines due to atmospheric disturbances, and it may be used at high voltages.

The interesting new Wynn Williams Geiger apparatus for cosmic ray investigations was demonstrated. This instrument counts alpha and beta particles in radioactive disintegration. A counter tube is filled with gas at low pressure and when a particle enters the gas is ionised, a thyratron valve being operated. Also exhibited were a newer and simpler model of a Campbell-Larsen a.c. potentiometer; the Dye vertical force magnetometer which balances the vertical component of the earth's field against a steady current passing through a Helmholtz coil system with its axis vertical; and a more convenient and less expensive form factor meter with only one unipivot galvanometer, instead of two as in last year's model.

The latest pH meter has a range up to 14 pH units or to 1,400 millivolts, and readings may be taken directly to 0.02 pH unit or 2 millivolts. The eupatheoscope designed in collaboration with the Building Research Station for the Medical Research Council measures and records a quantity analogous to the physiological sensation induced by a cool environment.



"Wynn Williams" apparatus for counting particles in radioactive disintegration; the alpha and beta ray tubes are shown separately on the left

Entirely new apparatus for analysing heavy water utilises the difference in thermal conductivity of hydrogen and deuterium.

The well-known model B thread recorder has been considerably modified and is now supplied for either one or two points, while the totally enclosed thermo-electric indicator modifications have resulted in an increased scale length, a larger number of switch points, and an improved type of switchgear.

R. M. Catterson-Smith

A selection of small resistance furnaces included muffles for dental and experimental use. They are fitted with "Kanthal" ribbon or platinum windings suitable for temperatures up to 1,350 deg. C.

E. K. Cole, Ltd.

Bridges of the intermediate-frequency inductance, gang-condenser, portable impedance comparison and distortion factor types were on view, together with a valve voltmeter and beat-frequency oscillator, while methods of testing for short-circuited turns and pinholes in enamelled wire were demonstrated.

Crompton Parkinson, Ltd.

A new and smaller pocket "Tong Test" is arranged for taking readings

The pocket "Tong-Test"

down to as low as 4 A in a straight-through conductor. It is provided with a split "Mumetal" electro-magnet and moving element, and will give accurate indications on both d.c. and a.c. The three standard ranges are 0/20, 0/30, and 0/40 A, with the first clear readings at one-fifth of the maximum. A further improvement has been made in the standard range of moving-iron switchboard and portable pattern instruments. Without sacrifice of clearance these can now be critically damped and have a period of pointer swing before coming to rest, varying from 0.75 sec. to 1½ sec.

J. H. Dallmeyer, Ltd.

The "Parvux" illumination meter is direct reading and of convenient pocket size (10 oz.). The bakelite housing is enclosed in a leather case and the indicating instrument scale is calibrated from zero to 25/250 ft.-c. Self-contained and requiring no battery, the outfit has a light-sensitive cell built entirely of metal. Behind the lens is a self-generating photo-electric cell consisting of a thin film of selenium on a sheet of metal. This layer is covered with a thin coat of gold by cathodic dispersion. For the purpose of conducting the current away safely the gold is fitted at the edge with a metal ring. The entry of light releases photo-electrons which flow from the outside gold electrode through the measuring instrument. (An illustration of the meter appears on page 12.)

Drayton Regulator & Instrument Co., Ltd.

A system of proportional control of electro-valves, electrically operated dampers, speed regulators and similar

appliances, according to the magnitude of the variation of the impulse, makes use of potentiometer control. Parts of the equipment shown included a motor-operated valve with potentiometer resistance, a duct thermostat and a room thermostat.

The "Pilostat" is a room temperature control switch, for which a capacity of 25 A a.c. or d.c. is claimed with a temperature variation of $\pm\frac{1}{2}$ deg. F. A triple - pole 50-A solenoid - operated mercury switch was shown with mercury switches in which the quartz glass is protected by porcelain fused into the glass at the point of make and break and over that portion of the tube where an arc could strike the glass. A particularly compact single-pole solenoid operating mercury switch relay has a coil consumption of only 1.8 W on 100 V d.c. or 200/240 a.c., 50 cycles.

Dubilier Condenser Co. (1925) Ltd.

Moulded bakelite resistances in 0.5 and 1-W ratings were recently introduced by the company, as also were radio volume controls embodying the metallised filament resistor principle. Radio anti-interference units and motor noise suppressors and a large variety of condensers were displayed.

Ebonestos Insulators, Ltd.

This display was confined to various mouldings in "Ebonestos" composition, bakelite, and other synthetic resins, together with examples of mouldings which apply specially to the electrical and instrument-making trades.

Edison Swan Electric Co., Ltd.

Apart from the "Escura" 250-W discharge lamp, there were radio transmitting and amplifying valves and a low-power very short wave oscillator with graphite anodes dissipating up to 100 W. A new sealed-off high-vacuum cathode-ray oscillograph tube for accelerator voltages up to several thousands has improved modulation characteristics, and is therefore particularly suitable for television.

Among grid-controlled mercury-vapour and gasfilled relays for use in time-base circuits one form is capable of generating sawtooth wave-forms of several hundred kc. There was a high-voltage rectifier equipment for supplying power for the new cathode-ray tube; oxide-coated cathode gas-discharge rectifiers for battery charging, cinema arcs, &c., and a small five-circuit charger, shown using a bi-phase six-ampere valve.

W. Edwards & Co.

A vacuum oven which is electrically heated and automatically controlled, has been designed for rapid low-temperature evaporation. Many designs of vacuum pumps are made, and neon tube manufacturing equipment is supplied.

Elliott Brothers (London), Ltd.

An improved device (Brewerton's patent) has been developed for indicating or recording in any number of situations up to ten the velocity of the wind in ft. per sec., and its bearing or direction in degrees. The principal improvement is the steadiness with which the device indicates the mean direction of the wind, the design being such that it is unaffected by cross eddies and gusts of short duration. The anemometer will operate at a minimum wind speed of 5 ft. per sec., and at this speed will indicate the direction within 5 deg. At higher speeds the direction may be relied upon to within 2 deg. An electrically operated brake is fitted to prevent the fan from rotating when indications are not required.

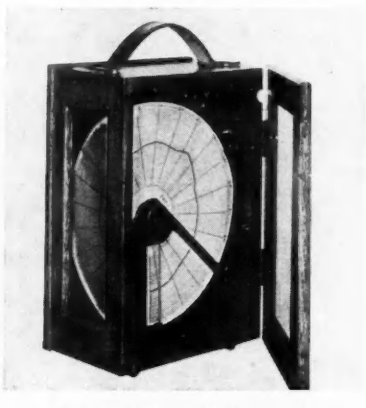
An improved wind speed and direction indicator

The Elliott transmission system (Shotter patents) enables the deflection or movement of almost any electrically or mechanically operated mechanism to be transmitted to a distant receiver. The maximum permissible resistance of pilot wires is 3,500 ohms and two pilot wires only are required. The system can be operated from any ordinary a.c. circuit and the accuracy is such that readings at the transmitting and receiving ends will not differ by more than $2\frac{1}{2}$ per cent.

Indicating and recording ring balance meters for draught, pressure, and flow are designed to measure with accuracy even the smallest variations. The accuracy is not affected by the quantity or specific gravity of the liquid used, and the range of the instrument is easily altered by changing the counterbalance weight.

Everett, Edgcumbe & Co., Ltd.

A new photo-electric street lighting photometer uses an "autophotic" cell and comparisons down to 1/100th of a ft.-c. can be readily made. The angularity error is negligible up to angles of incidence of 70 deg. or more. The miners' lamp photo-electric photometer is a pattern just introduced to meet the recently published regulations and enables the c.p. in any direction to be measured, as well as the minimum c.p. and the average over a given zone. A complete polar curve may be plotted. Another form determines at a single reading the mean-spherical c.p. of any lamp, including cap and inspection lamps. In the autophotometer an "autophotic" cell forms the test surface and is connected by flexible leads to the indicator, graduated direct in ft.-candles. Various single, double, and triple ranges have been standardised. A graphic photometer, which gives not only a continuous indication of the illumination, but also a permanent record, is particularly valuable to the control room engineer for measuring daylight. The "Cadet" portable grapher has been developed for use in street pillars, on a consumer's premises, and other situations where space is limited. The circular chart has an effective width of $2\frac{1}{2}$ in. and can be arranged to rotate once per day or once per week, as desired. It is driven by a "Synclock" motor, so that no winding is required and the time-keeping is always exact.



The "Cadet" portable grapher

A series of electrical speed indicators and tachometers, both fixed and portable, was shown. A portable insulating oil tester embodies a 40-kV transformer, a B.S.S. test cell, a regulating potentiometer resistance, and a voltmeter scaled direct in kilovolts. In the "programme clock" recently introduced for the ringing of bells in schools or institutions to a given programme (which may be varied) the driving and timing mechanism is a "Synclock" motor. Another instrument embodying this mechanism is the maximum demand tell-tale for warning consumers when a predetermined demand (kW or kVA) has been exceeded for a predetermined time, each of which is adjustable. Among radio measuring instruments the "Radiolab" set and valve tester has undergone several improvements. A recent innovation is the output meter with three scales of 0-40, 0-400 and 0-4000 milliwatts, besides a scale of decibels to a reference level of 50 milliwatts. A larger and somewhat more comprehensive output meter embodies an impedance matching transformer with tappings so that valves of all descriptions can be matched to a standard equivalent load of 600 ohms.

A new form of valve voltmeter covers various ranges from 0-5 up to 0-150 V and is operated entirely from the a.c. mains, thus eliminating all batteries. The method of zero adjustment is novel and, being entirely electrical, is much more flexible than the mechanical arrangement.

Evershed & Vignoles, Ltd.

An equipment specially designed for water level indication with a 36-in. scale has no electrical contacts in the transmitter or other part of the circuit, the variation in the current which provides the indication being obtained by altering the inductance in the circuit. The accuracy of the reading is independent of variations in frequency and in the voltage of supply. A particularly sensitive recording instrument with a resistance of 1,500 ohms per volt, for use as a voltmeter or an ammeter in connection with electrolysis investigations on tramway systems, consists of a recorder in which the marking of the chart is made through a typewriter ribbon by periodical tapping of the needle on the paper at four dots per minute.

An automatically protected leakage ammeter (Knowles-Shotter patent) makes use of the characteristics of "Mumetal." The transformer core becomes saturated at what may be considered to be the normal maximum earth leakage current; any increase in this current has practically no effect on the secondary current.

In the Evershed-Midworth equipment for the transmission to a distance of the indication, recording, and integration of flow, using a ring gauge made by George Kent, Ltd., as the originating movement, the current transmitted is varied in proportion to the originating quantity. The "Meg" insulation and continuity tester scale reads up to 100 ohms and the first half of the scale enables resistances up to 2 ohms to be measured in fractions of an ohm. A two-range "Meg" earth tester with a range of 0-3,000, and a switch to divide by 1 and 10, has been specially designed for use where the resistance of the soil is high, and stray a.c. or d.c. currents have no effect on the readings obtained.

Ferranti, Ltd.

For testing illumination a photovoltaic cell is combined with a $2\frac{1}{2}$ in. dial moving coil instrument calibrated to read directly in foot-candles the intensity of incident light at the cell surface. Ranges of 25 and 250 ft.-c. are provided. A maximum demand ammeter works on a thermal principle with a time lag of 10-15 min., thus giving readings which are more useful for general purposes where heating considerations are involved. Instead of operating by friction, the

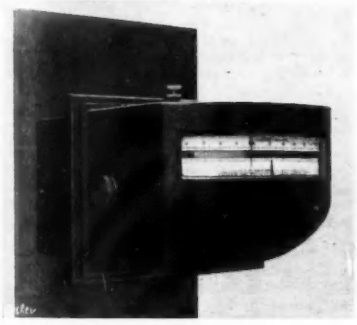
Ferranti light tester

demand pointer has a patented form of construction which is vibration proof.

A number of synchronous motors of the self-starting variety and of patented construction were shown. When used in an electric stop clock this type of motor gives time operations to within 0.02 sec. When used in a watt-hour meter form of construction, with the shunt core heavily lagged, the disc tends to run backwards on light loads but is prevented from doing so by a catch. On heavier loads the forward torque exerted by the series coil overcomes this and the disc runs forward, finally causing a mercury switch to operate. In automatic synchronising equipment the principle of the thyratron is used.

Foster Instrument Co.

In addition to a complete range of electric temperature-measuring apparatus and automatic temperature controllers a new "Flexipush" automatic temperature controller for use with oil, gas, or electrically heated furnaces dispenses entirely with the usual delicate magnetic relays and contacts. The main control, in the form of a large sealed mercury tube switch, is operated directly by the temperature pointer through the medium of Bowden-wire type transmissions. A new continuous chart pyrometer recorder (double-pivoted direct deflection) is of simple construction, providing good sensitivity and a wide 7 in. chart without the complications attendant on the use of the potentiometer principle. Refinements include electric drive with variable chart speed, automatic chart rewinder, and an automatic door-operated safety device. Multi-



The "Flexipush" controller

point records up to a maximum of six are possible, each being in a different colour and produced by a continually moving multicolour ribbon in conjunction with a double-pole selector switch.

A three-view introscope of new design is suitable for the general interior examination of large barrels and metal drums, and is capable of providing upward, downward, and radial views. The instrument was demonstrated alongside the more complicated "gas bottle" introscope used for the detailed interior examination of gas cylinders.

A. Gallenkamp & Co., Ltd.

Besides a new motor-driven single-stage rotary oil-sealed vacuum pump, the display included a range of electric ovens with automatic thermostatic control to ±1 deg. C. for 37 to 100 deg. C., or 50 to 300 deg. C. for drying, baking, and conditioning. Furnaces are made with wire-wound heating elements up to 1,000 deg. C., with thermostatic control, and with Silit heating elements up to 1,400 deg. C.

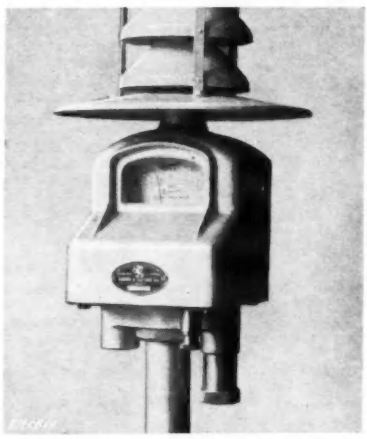
Copper-constantan thermo-couples of 250 junctions have a sensitive action, and the special design reduces the lag so that steady readings are quickly obtained; a straight-line model with 70 junctions is made for spectroscopic work. Davies' improved plug resistance boxes have the contacts enclosed in bakelite to exclude dust and dampness. New pattern Wimshurst machines with bakelite plates and porcelain insulation have an improved performance in damp weather. Dry metal rectifiers are supplied for laboratory use in place of accumulators.

Gambrell Bros. & Co., Ltd.

Galvanometers included a portable pattern for a.c. or d.c., which requires no levelling. A universal test set, bridges, fault locators, insulator testers, condensers, a sub-standard wavemeter, a valve generator of pure wave form for bridge work, and non-reactive resistance boxes were included among the exhibits.

Griffin & Tatlock, Ltd.

Sand's electrolytic analysis apparatus is designed primarily for the rapid



Part of Budgetts' scent indicator (an electrical aid for the hunter)

separation of metals by graded potential, but it is equally suitable for simple electrolytic depositions and, in conjunction with its accessories, is applicable to potentiometric and conductimetric analysis and also to potentiometric pH measurement. The platinum electrodes are of unusual interest, being so designed that the heavy weight of platinum formerly employed has now been reduced to about one-quarter, thereby decreasing the initial cost. The inner electrode is mounted on a glass frame and leads are taken from the platinum to a silver rod at the top, which is sealed to the glass frame.

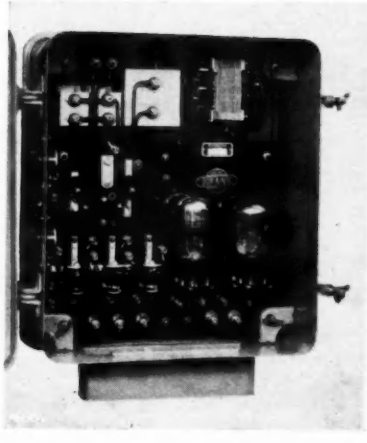
Budgetts' scent indicator is a novel application of physical and electrical principles to hunting. The theory has been developed that hunting by scent is either good or bad according to whether the earth is warmer or colder than the air above it. Thus, by employing resistance coils in a bridge circuit, arms of which are below and above the surface of the earth, it is simple to calibrate the galvanometer to read "good" or "bad."

Henry Hughes & Son, Ltd.

Magneto-striction echo sounding gear giving visual indication of the depth of water below a vessel, or fitted with recorders, is made in various types for use on launches and larger ships.

Igranic Electric Co., Ltd.

An electronic timing device has been designed for automatic control of electric welding and similar processes where consistent and accurate timing of a repeated cycle of operations is desired. The timing is controlled by a triode valve and can be varied over a wide



The Igranic electronic timing device

range. The range of time adjustment is from 0.1 to 16 sec.

A new principle for the operation of standard circuit breakers consists of substituting a few links of standard roller chain as the mechanical connection between the manual lever and the contact lever.

An eddy current actuated overspeed and underspeed mechanically operated rotary automatic control switch is designed to act as a pilot control in conjunction with an a.c. or d.c. magnetically operated contactor or self-acting starter. It responds to variations in the speed of the motor or machine shaft to which it is mechanically coupled, and can be used to stop the machine or motor in the event of a safe speed being exceeded. If the speed falls the switch can throw off a magnetic clutch or start a second motor.

For localised machine tool and workshop illumination "Lo-vo-lite" fittings operate in conjunction with step-down transformers that reduce the voltage to 12 or 25 V for 12-W lamps, which are mounted on adjustable extension arms. A double-pole double-break switch and two porcelain replacement fuses are incorporated within the transformer case.

Isenthal & Co., Ltd.

Improved patterns of mercury switch relays include designs employing clockwork to introduce time-delay features and a plunger type avoiding the use of flexible connections. A new impulse type of switch requires instantaneous excitation of the same coil to close or open the switch. Other patterns embody fused-in ceramic liners to ensure reliable operation under strenuous electrical conditions.

Among automatic voltage regulators the oil servo-motor device and vibrating-contact rapid-action patterns indicate modern developments. An entirely new type of automatic regulator employs the principle of variation of the compression of a carbon pile under the control of a voltage coil. The latest voltage controller is employed to vary incoming a.c. supplies by hand, or to maintain automatically constant voltage from a varying supply. A selection of the latest improved types of laboratory and power station rheostats includes modern carbon pile compression rheostats for meter testing and similar work.

Claude Lyons, Ltd.

This selection of laboratory instruments was chiefly applicable to radio and communication measurements. It included a megohmeter, "microvolter," bridges of several types, a harmonic wave analyser, condensers, a reactance meter; apparatus for the measurement of the sensitivity, selectivity, audio-frequency fidelity, stage gain and output power of radio receivers; resistances, potentiometers and microphones of various types, and photoelectric cells.

Marconiphone Co., Ltd.

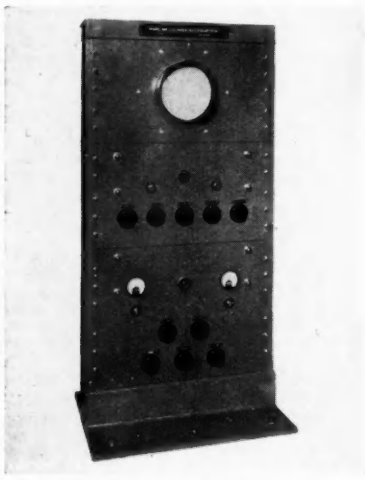
The complete range of 1935 radio receivers was on view, including model "296" five-valve superheterodyne with a.v.c. and visual tuning. Among several radio-gramophones was model "292" nine-valve superheterodyne with adjustable selectivity q.a.v.c., visual tuning, and automatic record changer. The new model K.25 pick-up incorporates an armature of special light construction. There was a full range of 2-V a.c. and d.c. and universal valves, battery valves and rectifiers; also a new output tetrode having characteristics similar to those of the normal output pentode. Anti-static aerial equipment was on view with records of electrical interference and a manual on the subject.

Marconi's Wireless Telegraph Co., Ltd.

Single sideband and carrier broadcast input equipment enables a carrier and one sideband only to be radiated from a broadcast transmitter, the other sideband being suppressed. This "split band" system comprises division of the audio-frequency band, successive modulation of the parts of this band, and their subsequent re-combination. Type 482C frequency-measuring equipment and double pen recorder has a master-oscillator crystal control possessing a stability of 1 in 1,000,000. A clock is driven synchronously from the master oscillator by the aid of frequency division in the multivibrator system, and this clock is compared with standard time signals, thus giving the exact frequency of the master oscillator.

A portable valve diathermy set is designed for the dual purpose of therapy and electro-surgery, for each of which purposes different circuits have been designed. The variable condenser in the

patient's circuit makes it possible to "tune in" the patient to resonate with the oscillating circuit, and by means of the variable coupling the maximum effi-



The Marconi cathode ray oscillograph

ciency is obtained according to the impedance of the part of the body under treatment. For therapy 1,000 k.c. per sec. is used, and for surgery 3,000 k.c.

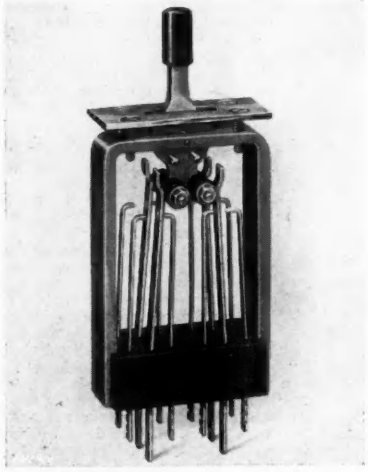
A cathode-ray equipment has a three-panel rack and a camera. The time base unit comprises an improved four-valve, hard-valve time base, the time of traverse being adjustable within wide limits from extremely low frequencies to radio frequencies. The wave form to be examined can be synchronised with the time base, and facilities are provided for a single traverse to be obtained by pressing a key.

Mercury Switch Manufacturing Co., Ltd.

Since the last exhibition considerable experience has been gained with regard to fused-in liner type mercury switches. Several new forms of these switches have been developed for various applications, and there is also a wide range of switches for heavy duty and loads from 10-50 A; vertical relay switches for operation by electro-magnetic circuit, and a selection of small switches for wireless and instrument application were other exhibits.

Muirhead & Co., Ltd.

Among radio and instrument components a general design of rotary stud switch has been developed for adaptation to many purposes. An assembly of low capacity key switches was shown. The contact springs are made of phosphor bronze of rectangular cross-section and are clamped in slots cut in the insulating blocks. The length of the springs allows considerable movement, thus making a wiping contact between the tips. A barrel switch was shown with three banks of 24 points ganged together for switching a series of different ratio out-



A Muirhead low-capacity switch

put transformers. An attenuator (type 11) consists of a resistance network terminated in a slide wire. The range of the attenuator is 0-500,000 microvolts and the output impedance is 5 ohms.

A measuring set operates by substitution in the tuned circuit of a radio frequency oscillator, the null indicator being visual. It is possible to measure any capacity up to 1,000 micro-microfarads with a discrimination of 0.03 micro-microfarad. A radical departure from standard practice is employed in the conduit high fidelity microphone designed by Mr. P. W. Willans, the basic idea being the effective removal of the microphone from the sound field by the attachment to its input side of a long conduit. The instrument can be used as a high quality telephone by providing a connector at the end of the tube shaped to fit the ear and introducing speech currents into the strip.

Multitone Electric Co., Ltd.

Deaf-aid speech amplifiers demonstrated by the company are claimed to provide "unmasked" hearing. Two headphones are used, one for each ear, one reproducing high notes only, and the other the whole scale. Since the low and middle notes delivered to one ear cannot be masked by the high notes introduced into the other, intelligibility is said to remain high irrespective of the intensity level. Besides portable battery-operated outfits a combined radio set and deaf-aid speech amplifier is supplied for mains or battery operation.

Nalder Bros. & Thompson, Ltd.

This company has recently placed on the market a direct reading meter which measures the intensity of light in ft.-candles and is made in various patterns. The standard arrangement consists of a light sensitive cell mounted with a microammeter. In another form the light sensitive cell is separately mounted and is connected to the microammeter by means of a pair of flexible leads. The series of "Bijou L" type instruments is now made in two sizes with 2½-in. and 4-in. dials. A portable a.c. testing set, comprising a long scale 2½-in. dial am meter, voltmeter, wattmeter and power-factor meter, weighs only 5 lb. and measures 7 in. by 11 in. by 3 in. A new miniature direct-reading power-factor meter weighs less than 3 lb. It has a 4-in. diameter dial with 10-in. long scale, and is self-contained up to 50 A and 500 V. Type CM relay, for protecting direct-started induction motors has a time delay of the order of one second; normal working overload and time settings are accomplished by means of simple adjustments on the face of the relay.

A recent development is the surge-proof d.c. inter-tripping relay for pilot wires in which a.c. induced or d.c. discharge currents may appear during fault conditions in adjacently situated main cables. The relay operates with 30 mA at 30 V d.c. in 0.2 sec. Another development is a series of automatic switches for earth leakage protection of the single and double pole types. The double pole switch is also available in the form of an ironclad cooker control unit, incorporating the standard 5- or 15-A sub-circuit and complete with indicator lamp.

Negretti & Zambra

A combined thermocouple and resistance pyrometer for use where there is a wide variation between suitable temperature ranges for different points in a multipoint installation is provided with a scale having two ranges, one for high temperature and the other for lower ranges, where the elements used are of the resistance type. A two-way "range" switch either connects the indicator to a thermocouple point selected by a rotary switch, or inserts it in a bridge circuit, when it indicates the temperature of a selected resistance bulb element.

A new range of electric contact thermostats and pressure gauges has alternative contact mechanisms as follows: (*a*) with one or two platinum contacts; (*b*) with a light mercury-in-glass switch to carry up to 1 A at voltages up to 250; (*c*) with a trip-operated mercury switch to carry 5 or 10 A at 250 V.

A portable potentiometer testing outfit designed for calibrating and checking rare-metal or base-metal thermocouples has its slide wire and all switch contacts totally enclosed as a protection against the collection of dust.

Philips Industrial

Besides "Metalix" shock-proof apparatus for X-ray crystal analysis and the "line" focus research tube, there was an improved sodium lamp for analysis involving the use of polarised light, rectifiers, photo-electric cells, barretters, rare gas fuses, hot-cathode relay tubes, mercury switches, oil condensers, transformers, and neon irradiators for the stimulation of plant growth.

W. G. Pye & Co.

McFarlane half-cells and a valve potentiometer with a sensitivity of one-tenth millivolt are intended for the rapid determination of hydrogen-ion concentration. Among Dolezalek electrometers was a new gold-leaf electroscope for mounting on the body of a microscope or for projection purposes. Also galvanometers and a Bragg X-ray spectrometer with a universal X-ray photo-goniometer whose interchangeable parts enable tests to be made of crystals with the same settings of each instrument.

Salford Electrical Instruments, Ltd.

Besides the 2½-in. instruments, a new size (3½ in.) is now available for flush mounting. A photometer for quick approximate comparison of similarly rated lamps by unskilled operators has two cubical compartments with a lamp in each. A colorimeter will compare the colour and capacity of two liquids when the difference is too small to be discernable by direct visual methods. An earth-continuity test set has its scale shape so modified that, although the highest resistance indicated is 15 ohms, the 1-ohm point is near the middle of the scale. A range of portable precision dynamometer wattmeters for a.c. measurements can, of course, be checked and used on d.c. The movement is air-cored, but the whole is shielded from external fields.

For measuring voltage, current, and power factor in a.c. circuits without breaking the connections there is a portable instrument, while a switch intended for lighting circuits where illumination is required for short periods, such as for corridors, cupboards, and stairs, contains an air dashpot which is adjustable and so controls the rate of operation. It may be set to switch off between a few seconds and many minutes.

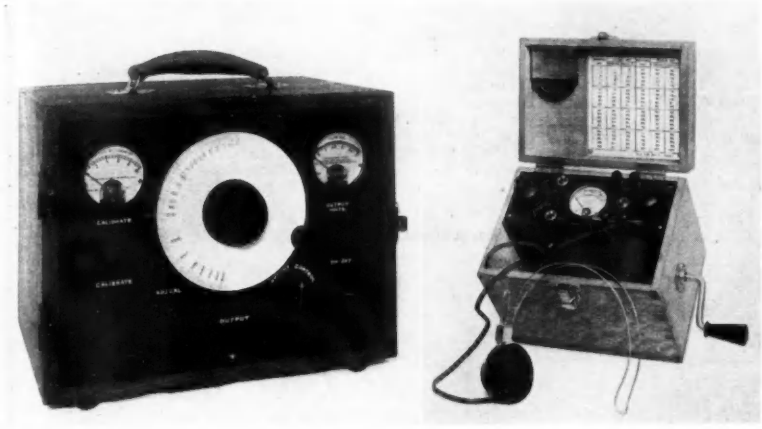
Standard Telephones & Cables, Ltd.

There is now available a portable heterodyne oscillator, battery operated and of compact design, the output being uniform over the whole range. A direct-reading transmission-level measuring set covers the frequency range of 20-10,000 per sec. with one calibration and to an accuracy of ±0.02 decibel.

A gain set intended for routine measurement in small repeater stations is constructed as a compact rack-mounted unit with hinged front and includes a fixed frequency oscillator, the gain range being 30 decibels. There is a total gain of approximately 75 decibels in a detector amplifier, which is suitable for both voice and carrier frequencies and makes use of a special permeability tuned oscillator and heterodyne detector and tuned amplifier. For use in the manufacture and installation of telephone cable a test set measures the mutual impedance of pairs of circuits in millimicrohenries, and effective resistance in milliohms. A carefully screened and balanced bridge has been specially designed for the rapid and accurate measurement of the capacity unbalances in lengths of telephone toll cable, and for the measurement of mutual capacity of pairs and phantom circuits. A transient recorder makes use of a cathode-ray oscillograph in which the transient automatically switches on the oscillograph beam, initiates the time base, and returns the circuits to normal. In a camera designed for film speeds from approximately 1 in. to 20 in. per sec., and also for single stationary shots, facilities have been provided for the film to be moved on automatically after each transient operates the transient recorder.

A single-traverse time base provides a means of moving the spot once across the screen of the cathode-ray oscillograph. Transients may thereby be recorded which are beyond the speed range of the moving film camera. There is a small self-contained cathode-ray oscillograph which operates off a 2-V accumulator contained inside the case. The high voltage for the anode is provided by an induction coil and rectifier. A single-traverse time base, which is variable in fifteen steps from approxi-

mately 1 cm. per sec. up to 50 metres per sec., is incorporated. A noise meter is provided with additional batteries to extend the range. Measurement is by the subjective method, a complex reference tone being generated by a clockwork-commutator device and a telephone receiver fitted with an offset. An electro-



A portable heterodyne oscillator and a noise meter (Standard Telephones and Cables)

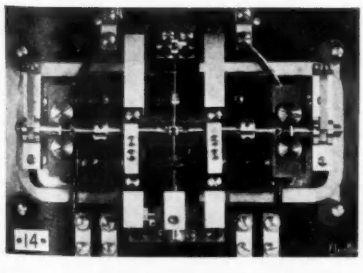
cardiograph provides means both of seeing and recording photographically the small periodic voltages associated with the heart-beat.

H. W. Sullivan, Ltd.

This was a display of crystal and fork frequency standards and wavemeters; inductance and capacity standards for all frequencies; dual range capacity bridges and other test sets; audio oscillators and a.c. bridges, &c., hot-wire ammeters for high frequencies, and a portable telephone cable capacity unbalance test set.

Telegraph Construction & Maintenance Co., Ltd.

The principal exhibits were telegraph relays with "Mumetal" cores for use on tape-machine circuits operating on less than 20 microwatts. Railway signalling track relays employing "Mumetal" and "Radiometal" cores result in improved sensitivity and a higher "on/off" current ratio and there are also protective relays with "Mumetal" magnetic circuits for power transmission systems. The high permeability of this alloy is advantageously utilised in screening boxes designed to eliminate stray magnetic fields associated with amplifiers, radio receiving sets, and cathode-ray oscillograph equipment, together with pressed, welded and riveted boxes of various types, including those constructed of "Telcon Plymax" ("Mumetal" backed with ply-



A telegraph relay with "Mumetal" cores (Telegraph Construction & Maintenance Co.)

wood). A magnetically screened conductor consisting of the alloy on suitable copper wire is of considerable value in wiring up amplifiers or radio equipment, while 2129 alloy magnetic screens for shielding intervalve transformers in commercial radio receivers have proved very effective, the material also having specially good mechanical properties for this purpose.

Resistance alloys are available in various "Pyromic" and "Calomic" sections, gauges, and finishes, with wires drawn to less than 1 mil diameter. "Megapyr" is an iron-chrome-aluminium wire for high temperatures. Bimetallic strip and thermocouple alloys are marketed by the company and also such vacuum treated and degasified metals as nickel-iron wire and pure iron strips for use as valve electrodes and for metal-to-glass seals.

A variety of cables and wires for telephone and broadcast relay work is available with "Telconax" insulation and sheathing, this material being tough, flexible, and strongly resistant to moisture and chemicals. Cable is also made which is claimed merely to char, but not to burn.

Thermal Syndicate, Ltd.

Mercury-vapour burners for a.c. and d.c. included a low-pressure pattern with a quartz jacket which has been designed for the continuous sterilisation and irradiation of liquids. The "Vitreosil" point source burner for d.c. only has a short intense arc suitable for use as a microscope illuminant.

H. Tinsley & Co.

For accurate resistance and capacity measurements at radio frequencies up to 6,000 kc per sec., type HF.2 bridge (series-resonance) in its simplest form consists of two fixed resistance arms, one variable non-reactive resistance arm and a fourth arm made up of a condenser in series with the inductance. The circuits are all screened upon a carefully arranged plan to eliminate errors due to spurious capacity effects, but this does not affect the principle. The advantage of this type for inductance measurements is its high sensitivity and the absence of coupling between magnetic fields. The inductance is also tested under the conditions of resonance in which it will most probably be used.

An inexpensive three-range general-utility potentiometer enables measurements to be carried out very accurately over the whole of the usual working range. The slide wire dial is engraved in accordance with an actual calibration so that its accuracy is not dependent on any assumption of uniformity, while the meter reads down to 5 divisions negative. The potentiometer current can be standardised on all three ranges by turning the selector-switch dial and balancing for zero galvanometer deflection by operating the potentiometer current control knob.

With type 4107 direct-reading matching set for routine testing of mass produced radio condensers full-scale readings are obtained with ± 30 micro-microfarads out of balance, and condensers having capacitances of from a few micro-microfarads to 1.3 microfarads can be measured with an overall accuracy of 1 per cent. Type 4106 limit bridge was designed primarily for high-speed precision testing of such apparatus as mass produced resistance units and volume controls, &c. The percentage "off nominal" when inserted in an appropriate external jig can be read directly from the indication of the light pointer on the scale. An oil-immersed rotary reversing switch free from thermo-electric effects has been specially developed for use in conjunction with high precision thermo-electric potentiometers (Diesselhorst type) or similar apparatus.

Ernest Turner Electrical Instruments, Ltd.

Laboratory, portable precision, and miniature measuring instruments are supplied in a varied range of sizes and types; also rectangular and switchboard patterns, radio-frequency instruments, testing outfits, relays, galvanometers, voltmeters, ohmmeters, and milliammeters, including a rapid indicating thermo pattern.

Venner Time Switches, Ltd.

In addition to a varied selection of time switches there were several types of oil-break switches for heavy duty, the electrically operated type having been improved. New additions to the range of clocks are the "Syn-spring" (two sizes) and a synchronous motor pattern equal in size to the smallest hand-wound clock. Stop watches included an electrically wound variety. There were a direction-finding watch compass, wireless light-house switches, and a buoy lamp for cable ship maintenance work. Besides a flasher for controlling signs and relays for operating street and kiosk lighting, there were meters of the prepayment, rent collection, "Wrad-slot" "Cost-i-meter" fixed and running charge, and two rate types; the last-mentioned changes from high to low rates or vice versa at any preselected time. An hour meter for use on controlled frequency supply records operations in terms of hours up to 1,000. There is a rebater for off-peak water heating control.

E. R. Watts & Sons, Ltd.

A magnetic variometer for geophysical surveying incorporates the "Templeton" patent optical system.

Western Electric Co., Ltd.

Sound measuring equipment enables noises to be analysed for the determination of the various component frequencies and reverberation time to be measured. The noise meter visually indicates loudness in decibels above a fixed reference level and the analyser is capable of determining frequency components in bands of 40, 160, or 640 cycles. Reverberation can be determined from two-tenths of a second upward. (An illustration of the equipment appears on page 17.)

Westinghouse Brake & Saxby Signal Co., Ltd.

Wireless enthusiasts were interested in the new instrument-type rectifiers, the improved characteristics of which allow them to be used for such special purposes as power output meters for audio-frequency amplifiers. There were demonstrations of a rectifier set providing a nearly constant d.c. output voltage over a very wide range of load; the new rectifier specially designed for laboratory work in schools and colleges; a pair of output meters, one reading peak and the other mean power output of a radio receiver; and, in the research section of the exhibition, a working exhibit of a 50 kV metal rectifier operated a high-voltage cathode-ray oscillograph and diffraction camera.

Weston Electrical Instrument Co., Ltd.

This display was divided into several portions, the historical section being

Weston Model E665 analyser for radio servicing

devoted to a practical demonstration of the contribution of Dr. Weston and his

associates to the art of electrical measurement.

In the industrial control section were various relays. Model 705 will operate on currents as low as 2½ mA and yet handle up to 5 W with 110 V on its contacts; it embodies a new principle of relay design. Due to the properties of this relay a smoke alarm device can be made of the utmost simplicity and robustness. It may be arranged to indicate when smoke in a chimney exceeds a predetermined density.

An illumination measurement section showed the wide range of "Photronic" photo-electric illumination meters and electric photographic exposure meters.

In the radio testing section were the E665 analyser and 694 oscillator, both of which have been specially designed for servicing work. The panel instrument section included new designs of 2½ in. and 2 in. instruments with sensitivities down to 30 mA full scale deflection.

In the laboratory section standard instruments were offered, both the permanent-magnet moving coil type for d.c. only and the electro dynamometer pattern for both a.c. and d.c. All have guaranteed accuracies under normal working conditions. The remaining two sections contained a number of interesting portable testing and switchboard instruments.

Zenith Electric Co., Ltd.

Laboratory resistances with new features giving smoother regulation, longer life, and lower cost are made in a variety of types for bench use, front-of-panel and back-of-panel mounting, equipped with non-inductive and anti-capacity windings. Industrial resistances for the control of voltage and current in new types have enclosures of special design permitting adequate ventilation but eliminating danger of shock. Examples of resistances were shown adapted to special purposes such as the vaporising of volatile fuels and oil engine starting.

Smooth control of secondary voltage from zero to the maximum is given by new regulating transformers with sliding contact adjustment. Phase shifting current and potential transformers are supplied for operating in conjunction with a testing equipment for calibrating house-service integrating meters, power-factor indicators, and wattmeters. There were also a portable testing set for house-service meters and small high- and low-voltage power transformers of new designs, besides high- and low-pass filter circuits for smoothing and eliminating interference in radio circuits; "Zenite" and "Vit-bond" wire-wound vitreous embedded resistance units in new types of mountings; and "Zenohm" heavy duty corrugated strip resistances for controlling the temperature of electrically heated muffles and furnaces.

Resistance Welding.

A method particularly suited to mass production

By F. G. Rogers, M.I.W.E.

EVERY production engineer accepts oxy-acetylene and electric arc welding as economical systems of engineering fabrications, yet many still regard resistance welding with awe and doubt.

Resistance welding comprises butt, flash, spot and seam welding and compares favourably with other systems of fabrication. One welding machine can be used for a variety of jobs, while little special apparatus, other than fixing jigs, is required to effect the changes.

The system is suitable for ferrous and non-ferrous metals of all types and for joining dissimilar as well as similar metals. In the welding of stainless steels there is little or no tendency for the material to show signs of decay at the weld. For very heavy sections resistance welding is not suitable on account of the large currents used, and the special electrical plant required to smooth this power if taken from the public mains.

The Various Processes

Butt and flash welding are used in general engineering for joining two or more pieces of metal. The process is suitable for any sections from circular and tubular to angle and girder. The maximum cross-sectional area of the material is limited by the size and cost of the plant and the relation which the cost of the completed job bears to the cost of the same job effected by arc welding, oxy-acetylene welding or other alternative system of fabrication.

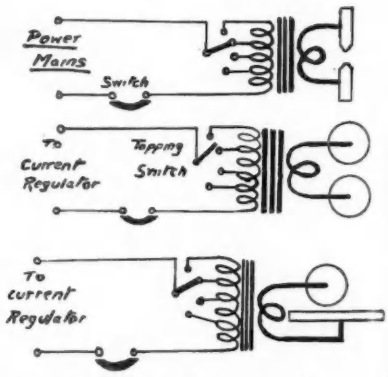
The "Parvux" illumination meter referred to on page 7

Examples of butt and flash welding are the joining of steel tubing and the joining up of the rim of a cycle wheel into a continuous ring. The sphere of application of these two systems of welding is wide; every individual job requires careful consideration and should be allocated to one or the other process depending upon the size and shape of the component parts.

Spot welding is effective when used in place of riveting, while seam welding is a line weld and is used in the manufacture of drums, tanks and hollow goods. Spot welding is becoming popular as engineers find that these welds, even when produced by unskilled or semi-skilled labour, male or female, at mass production rates, result in joints as strong as the parent metal. The saving of time compared with riveting is enormous, since the welding is effected in a fraction of a second by the pressing of the operating pedal. In addition, the result is neater and quite as reliable.

The welding machine is usually foot operated and thus the operator has both hands free to move the work. When the job is small a continuous flow of work can be arranged through the machine, the metal being picked up with one hand, welded and removed from the machine with the other. In such repetition work special design of the welding electrodes may be necessary so that a number of spots can be made simultaneously instead of individually. The seam-welding machine is a development of the spot welder and is, in effect, a continuous spot welder designed so that the spots overlap and thus form a perfect joint.

Electrically, spot and seam welding machines are similar, comprising a single-phase tapped-primary step-down transformer designed to give a secondary voltage sufficient to pass enough current through the work to produce fusion in the time allotted to the operation. Thus, in a spot welding machine, the secondary of the transformer is connected to two pointed electrodes between which the work is clamped while the current is flowing. These are replaced by two rotating wheels or one wheel and a bar electrode in the seam welder.



Top: Electrical arrangement of a spot welding machine. Centre: Seam welding machine with wheel electrodes. Below: Seam welding machine with wheel and bar electrodes

This arrangement permits a lap joint between two pieces of metal to be fed between the electrode wheels, which are power-driven, or in the case of the wheel and bar electrodes the work is held to the bar while the wheel passes over it from end to end of the joint. The series of overlapping spots is produced by supplying the machine with an interrupted current and adjusting the speed of feed.

Steel paint drums and tar barrels are good examples of successful results obtained by seam welding. These vessels can be subjected to very rough treatment without any failure of the joint, the reliability of which should prove attractive to the process engineer who wishes to cheapen a job normally extruded, made up of tubing or joined by the mechanical methods of the tinsmith. The process and operation are rapid and semi-automatic; hence inexpensive labour can be employed to work at the rate of three to ten feet of joint per minute, depending upon the thickness of the joint and the material being worked.

With the smaller plant generally used for industrial processes no undesirable conditions of loading are produced to disturb the supply engineer since it is possible, with proper plant lay-out, to obtain a good power factor and a well-balanced load on the three phases. Resistance welding as a general process of fabrication is only in its infancy, and it is usually found that the installation of one unit leads to many more on account of the highly satisfactory results which can be obtained.

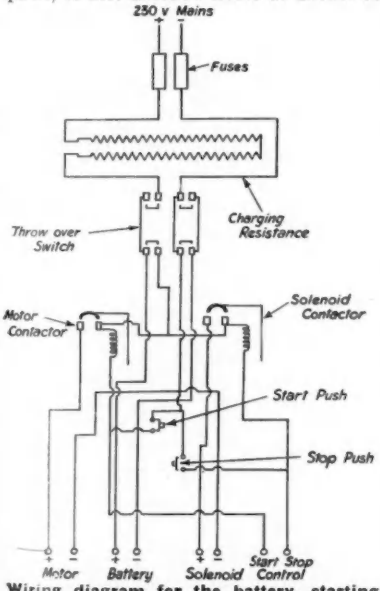
Automatic Hydro-electric Plant

A Yorkshire installation which has given trouble-free service for four years

A TESTIMONY to the reliability of automatic features on small hydro-electric schemes is provided by a plant which was installed in 1930 at Lord Holm restaurant, Hardcastle Crags, near Hebden Bridge, by Mr. A. Gibson. This has all its automatic features in full use at the present day. A horizontal shaft 19.5-h.p. Francis turbine works on a 16 ft. fall, being direct coupled to a 12.5-kW d.c. generator and controlled by an oil-pressure governor to run at 418 revs. per minute.

Short peak loads can be carried when the flow of water in the river is small by the aid of a storage basin, which is also used for pleasure boating, necessitating the maintenance of an approximately constant level. A 40-ft. submerged weir and strainer rack are provided at the intake to the turbine pit 6 in. below normal water level. The four strainers are of different mesh, and the last grating before the water reaches the turbine from the river has not required cleaning during four years' working.

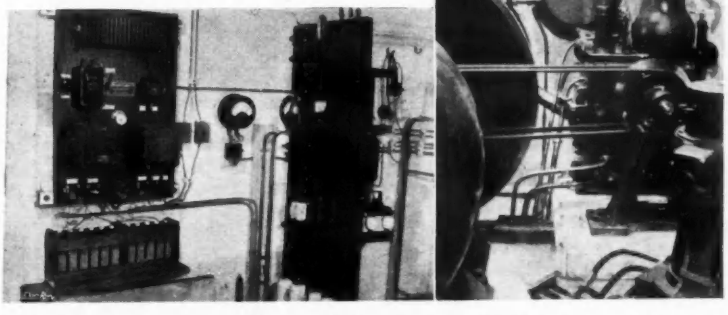
A local supply is given to the restaurant, but the bulk of the energy is conveyed by a 0.125 sq. in. overhead line (the poles of which also carry the control pilots) to Mr. Gibson's house at Greenwood Lee, some 460 yd. away up a steep rocky woodland bank on the other side of the river.



Wiring diagram for the battery, starting motor, and controls

The operations to be provided for in the control and automatic gear were as follows: (i) Starting and stopping of the plant either from Greenwood Lee or at the power house. (ii) Automatic limitation of output to prevent undue drop of level in the storage basin. The oil-pressure governor, which opens or closes the turbine gates in ordinary working, cannot of itself open them for starting because the oil pump is also then stopped and cannot supply oil to the servo-motor. An auxiliary oil pump driven by a ¼-h.p. motor fed from a 12-V 29-Ah nickel-iron battery (charged periodically from the main generator) has therefore been installed.

The oil from the small pump is fed directly into the main governor to operate the servo-motor in the opening direction. The motor cannot move the turbine guide vanes until a catch, which retains the vanes in the closed position when there is no oil pressure, has been released by a little servo-motor which itself is provided with oil from the small pump. A similar servo-motor mechanically closes the main circuit-breaker at the same time. The guide vanes are then opened, the turbine starts up and as soon as the dynamo is excited the circuit-breaker is held closed by the no-volt trip coil. The starting operation (which has never yet failed) takes about 12 to 15 seconds, and upwards of 100 starts and stops can be made on one charge of the battery.



Arrangement of the switchboard; battery and charging equipment; right, part of the power house

The "stop" push energises a solenoid operating a poppet valve which puts the full oil pressure on the governor servo-motor in the closing direction.

Water-level Speed Control

When the water level in the storage basin falls to 6 in. below its overflow sill a diaphragm operates but does not entirely close the poppet valve, causing the turbine speed to fall until the water in the storage basin has risen again, when the diaphragm releases the poppet valve. The gradual voltage drop draws attention to the need to reduce the load in order to restore normal running conditions. The main circuit-breaker is provided with an overload trip and over-voltage release coils.

The accompanying illustration of part of the power house shows, in the foreground, the vertical shaft oil pump and motor for starting purposes. Behind is the oil pressure governor driven by two belts from the turbine shaft. The case containing the diaphragm with its connecting pipes is mounted on the wall at the rear.

The water turbine and governor were manufactured by Messrs. Gilbert Gilkes & Gordon, Ltd., of Kendal, the generator and electrical equipment being supplied by the General Electric Co., Ltd., through its Manchester branch.

Insulating Varnish Application. By R. T. Fleming, A.M.I.E.E.

The general principles involved

A MAIN function of an insulating varnish is to maintain the insulating properties of the other materials by protecting them against the absorption of moisture. In order to achieve this result care has to be exercised in its application, and the varnish must be applied at the consistency best suited to the work in hand. In order to keep this consistency correct the checking of specific gravity is advantageous. Viscosity is the important factor in consistency, and while this does not bear any definite relationship to specific gravity in varying liquids, when one liquid is being employed, the value of specific gravity may be taken as a sufficient indication of viscosity.

In places where large dipping and impregnating tanks are used a daily check should be made on the points mentioned by charts (which can be easily prepared) indicating the exact amount of solvent to be added to bring the varnish back to the correct working condition. When reducing the varnish the solvent should be added slowly and the mixture stirred violently to ensure proper mixing, especially during cold weather. The rapid addition of solvent may cause curdling, in which case slight warming will restore the varnish to its normal condition.

Cleanliness of the varnish is essential, and the containers should be cleaned at least twice a year. The continual introduction of coils and apparatus into a varnish tank leaves a certain amount of foreign matter and it will be found that when the varnish is dry these substances break the continuity of the film, which will then have lost in some degree its dielectric properties and will also facilitate the absorption of atmospheric moisture.

The Baking Ovens

Heat for varnish baking ovens may be delivered, either by natural draught or by air blown in or exhausted. Exposed heaters (electric or gas) entail a risk of fire, as vapours from varnish are extremely inflammable and when mixed with air often form an explosive mixture. Gas jets must not be exposed to the atmosphere of the oven, because in addition to

the fire risk the water and sulphur fumes liberated during combustion reduce the insulating properties and also tend to cause corrosion and rapid ageing. All directly heated ovens should be jacketed and the heating chamber should have a separate ventilating system and should also be adequately lagged.

The ovens should be capable of maintaining a uniform temperature of at least 110 deg. C. In a number of instances, especially when synthetic resin varnishes are being baked, the temperature required may be as high as 140 deg. C. Apertures in the lower part of the structure must be provided for the ingress of pure air, and flues or vents at the top for the escape of hot air laden with the vapours resulting from the evaporation of the solvents and the oxidation of the varnish. The temperature distribution within the oven should be as uniform as possible.

An adequate supply of oxygen in a drying oven is of the utmost importance, as was shown by a test carried out upon metal strips dipped in two insulating varnishes with different drying characteristics. Varnish A dried in an hour when the oven atmosphere was changed once every minute, whereas when the air was renewed once every nine minutes the drying time rose to ninety-two minutes, a 63 per cent. increase in the drying time. With varnish B an increase of 44 per cent. was shown.

These results, obtained with a small experimental oven, are only given to show the effect of air supply; the numerical values are not to be taken to apply to large industrial ovens. From experience I consider that any oven, whatever the source of heat, should have a complete change of atmosphere at least ten to fifteen times per hour.

The following table is compiled from tests on ovens carrying out the same operation in different electrical engineering factories:—

Oven.	Cu. ft.	Changes of air per hr.	Heating.	Ventilation.
1	640	3.75	Steam	Natural
2	420	10.22	,,	,,
3	80.6	60	Gas	,,
4	30.6	177	Electric	Forced

Oven 1 is of no value, whereas oven 4 is uneconomical, as by changing the air 177 times per hour a large amount of heat is being wasted.

Application Processes

The foregoing notes have indicated the various precautions to be taken with the varnish itself and also the class of apparatus to be used in order to get good and efficient results. The actual processes which may be adopted are pre-treatment, dipping, and impregnation. The first method is the least employed, while the other two are closely allied and are by far the most important.

Windings of electrical machinery are, in general, covered with materials which absorb moisture. For good insulation this moisture must be removed and must not be reabsorbed. To achieve this result the windings must be treated with either oleo-resinous varnish, synthetic resin varnish or compound. Vacuum impregnation properly carried out is best, but this process requires careful handling; if done badly the result is almost worse than no treatment at all.

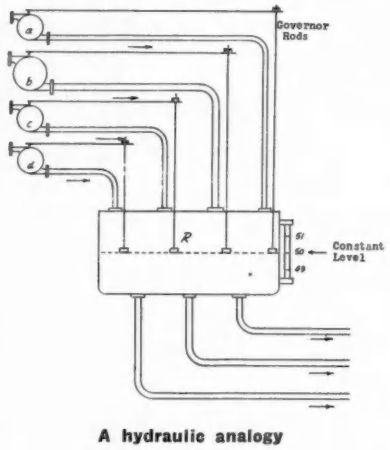
The Control of Frequency. By C. Mancha Bennett

A simple analogy to explain parallel running of power stations

THE generating stations connected to the grid may be looked upon as a number of pumps supplying a large reservoir, while the consumers or load can be looked upon as a number of pipes connected to the reservoir, drawing off the water delivered by the pumps, *i.e.*, the demand. The water in the reservoir must be kept at a constant level, this level corresponding to the frequency of the supply; the variation of level should not exceed plus or minus one-twentieth of the predetermined depth of the water.

In the accompanying diagram the selected stations are represented by *a*, *b*, *c*, *d*, and the reservoir by *R*. As the variations in demand may be rapid and of a high value, the selected station controlling the level in the reservoir should be that station with the largest-capacity pumps in operation, for if a station with a low-capacity pump attempted this duty it might very quickly become overloaded or drop the level of the water in the reservoir to a dangerous extent.

Let us suppose that there is a control centre which issues instructions to each of the stations regarding the level of the water in the reservoir and, further, that each of the stations has a means of knowing the exact level of the water in the reservoir. If the control centre instructed each connected station to maintain the level of water in the reservoir the fluctuation of level would be very great, not only because of the characteristics of the different pumps in the time taken to increase their output, but also because of the human element, *i.e.*, the operators not taking prompt and concerted action.



A hydraulic analogy

Imagine that the water level is higher than normal and that one station says: "My pumps are doing a good economical load. I am not going to reduce the output to lower the water level; let the others do it." This is not an unlikely happening, and points to the importance of a control centre having absolute power to make the connected stations promptly obey instructions. But a control centre would not be in a position to do this unless its officers themselves knew the exact conditions obtaining at the connected stations. This is practically impossible on a very large system owing to the unjustifiable cost of the necessary instruments.

The difficulty is easily overcome by allocating fixed loads to the pumps at the connected stations, which must not be altered without the consent of the control centre, and allocating to one selected station only the responsibility for keeping the water level in the reservoir constant.

This station can from time to time advise the control centre what alteration is necessary to any of the pumps at the other stations, although it would not mention individual stations, for the extent of the allocated load to each of the other stations would be known only at the control centre. There is no difficulty in this, the only essential factor being that the control centre should receive prompt obedience to its requests.

Whatever may be the ideas as to loss of prestige from not having complete command of the situation at the control centre, it is axiomatic that the duty of speed control must be in the hands of a substantially equipped generating station, and can never be situated in an office. There is no mid-way method, but there is a method of giving substantial assistance to the speed-controlling station based on common sense.

A great responsibility rests on the control centre in allocating correct loads at correct times to the various stations, but there is no greater responsibility than that of getting immediate action taken upon its instructions. This duty alone demands a perfect service of communication, and a complete understanding of the conditions obtaining.

Again referring to the diagram, it will be seen that a sudden demand lowers the level of water in the reservoir, immediately affecting the governor rods, and therefore the output of the pumps, the effect on each pump depending upon the sensitivity of the governor gear. In such circumstances, no action should be taken as regards pumps *a*, *c* and *d* if it is assumed that their governor characteristics are the same (this introduces very serious considerations which cannot be treated here), but immediate action should be taken as regards the pump *b* in the selected level-controlling station. By such action the level will be returned to normal and, if necessary, the selected level-controlling station will advise the control centre to get the output of pumps *a*, *c* and *d* increased, thus enabling the regulating pump *b* to drop output and return to normal.

Phosphorus in Coal and Coke

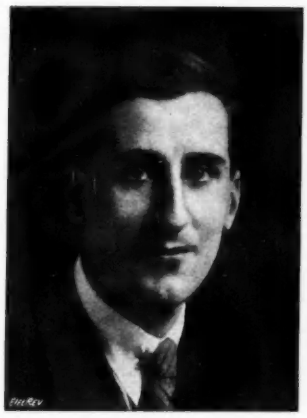
The British Standards Institution has just issued a standard method for the determination of phosphorus in coal and coke. Of nine methods tried as being representative of twenty different methods in use among the coke producers and users of Great Britain, the method selected as the standard is one of the two found to give consistent results, and of these two, is the more simple and economical in time. Copies of this method (No. 568-1934) may be obtained from the British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free.

Mine Lighting. By T. R. Barnard, B.Sc.(Tech.), A.M.I.Min.E.

The trend of modern lamp design

THAT coal mining is the worst lighted industry is incontestable, and undoubtedly its high accident rate is largely due to this fact. There are few directions in which research work is more likely to be profitable than towards improving the miner's hand lamps. The old standards of illumination under the Coal Mines Act were very low, demanding that the flame safety lamp should give a minimum candle power of 0.3 over a period of ten hours, and that the mean horizontal candle power of electric lamps over a period of nine hours should be at least 1 (1.5 through an arc of 45 deg.). Low as these standards were, in the case of electric lamps they were rarely complied with, the average c.p. for the old 2-volt lead-acid type being about 0.6.

As the result of the investigations and recommendations of the "Lighting in and about Mines" Committee, new rules were formulated and came into force recently. The new requirements for electric hand lamps are, briefly, that after nine hours' burning the mean spherical candle power must be at least 0.4 for cap lamps, or 0.75 for hand lamps (the m.s.c.p. for miners' lamps is about two-thirds the m.h.c.p.); the mean c.p. over the horizontal angle of distribution must be at least 1.5; and cap lamps must give at least 1 c.p. anywhere in a solid angle of 100 deg. The accumulator must also pass the following tests: After being discharged and recharged five times it is rested for half an hour, and then discharged at a constant current equal to the maximum permissible consumption of the appropriate bulb. During discharge the terminal voltage, with current flowing, is measured at the start and hourly for nine hours. The gravities of the electrolyte at the start and finish of the test are also recorded.

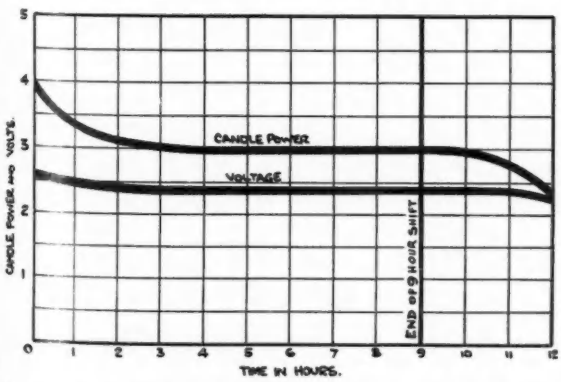


Mr. T. R. Barnard has had considerable colliery experience in Warwickshire and Lancashire, and is now engaged in teaching mining

Electric lamps are now available which will give from 3 to 4 c.p. at the beginning of the shift and well over 2 c.p. at the end. Thus, there is no difficulty in complying with the new regulations, but such lamps are not all that can be desired, as the light provided by a 3 c.p. lamp distant three feet from the work (as is frequently the case) is only ⅓ ft. c. This value is further reduced by the fact that coal only reflects from 4 to 10 per cent. of the light falling on it. Experiments by the Industrial Health Research Board have shown that for rough work an illumination of at least 3 ft. c. is desirable. For this the collier requires a lamp of 27 c.p., which would probably be impracticable in use owing to glare.

Benefits of Good Lighting

The advantages of good lighting are fourfold. First, there is a consensus of scientific opinion that a prime cause of nystagmus is deficient lighting; since the annual figure for compensation for this alone is about £500,000 and increased lighting has been found to result in decreased nystagmus, money spent on good lamps is obviously well invested. Secondly, better lighting on the coal face results in cleaner coal being filled, with the corollary of reduced haulage and cleaning costs. Thirdly, increased lighting generally brings



Curve showing voltage and c.p. of the "Ceag" alkaline hand lamp, type H.C.22

increased output. Last, the accident rate, especially for minor injuries, is reduced.

The opinion of the industry as to whether better lighting is to be sought from modern electric lamps or the new high candle-power flame lamps is shown by the following figures:

	1929	1933
Total lamps in use	784,843	661,689
	%	%
Flame lamps	51.3	40.9
Electric hand lamps... ...	47.1	54.7
Cap lamps	1.6	4.4

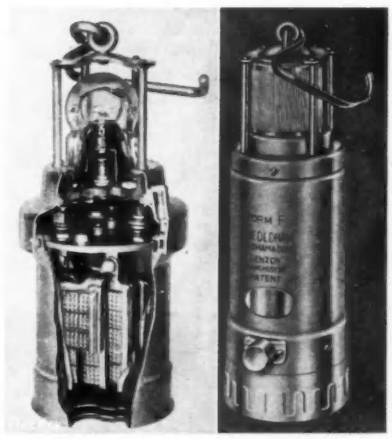
which reveal a large increase during recent years in the percentage of cap lamps used.

While cap lamps will always be at a disadvantage in deep, hot mines owing to the discomfort to the wearer, in other pits it is safe to say they will continue to increase, as the concentration of the light where it is required and the leaving of both hands free are important advantages, especially in mechanised mining. Nystagmus is noticeably less in districts where the cap lamp is popular.

In all electric lamps it is a safeguard to fit a fuse or other arrangement which will operate if the outer glass is broken, because the filament of even a 2-V lamp will ignite gas. Cap lamps are required by law to have such a device unless the cover glass is of the unsplinterable type.

Four Modern Lamps

The brief descriptions of four modern lamps which follow will give an idea as to the trend of modern design. It should be noted that the criticism of excessive weight so often directed against new electric lamps has been pronounced in the case of almost every lamp introduced since the "Davy." In practice, the men consider the added weight well worth carrying for the sake of the extra light. The use of collar lamps with pit ponies has proved of value, especially with restive ponies. The "Oldham" type F 4-V hewer's lamp uses a lead-acid accumulator, and was designed by the makers to enable users of their older 2-V hewer's lamp to modernise their equipment cheaply by fitting existing lamps with a larger battery and bulb. This was accomplished by constructing a double accumulator of the same diameter as the old one, but deeper, requiring a new base to the lamp to fit the old top part. The lid of the accumulator is of the snap-on type. With a 3-W bulb this lamp gives 1 m.s.c.p. after nine hours' burning. Using a spherical glass the m.h.c.p. after nine hours is 2.86. The lamp weighs 7½ lb. complete.



The "Ceag" lamp (H.C.15) in part section, and (right) the "Oldham" type F 4-V hewer's lamp fitted with cylindrical glass

The "Ceag" alkaline Type H.C.15 has a double cell nickel-cadmium accumulator, giving 2.6 V on an unusually flat discharge curve, which is assembled in a steel sheath insulated from the outer case. While being charged the battery is hung from the solid and springless terminals. An electrolyte level indicator enables speedy topping-up. Reflectors are fitted above and below the bulb to increase the h.c.p., and the large carrying handle is so designed that it cannot hit and break the glass. The lamp weighs 10 lb.

The "Concordia" type K.G. lamp possesses several distinctive features. The tubular positive electrodes of the battery are built of nickel-plated steel tape wound spirally and perforated. Alternate layers of nickel hydroxide and flake nickel stamped in complete an electrode of great strength, claimed by its makers to be more compact and light for its capacity than any other. A good feature of the lamp is the use of concentric terminals on the bottom half of the lamp, which is of two-piece construction. These contacts are serrated so that the act of switching the lamp on or off automatically cleans them by a scraping action, ensuring a flickerless light.

The lamp weighs 10 lb., and with a spherical glass gives 4.5 h.c.p., falling to 2.9 after nine hours.

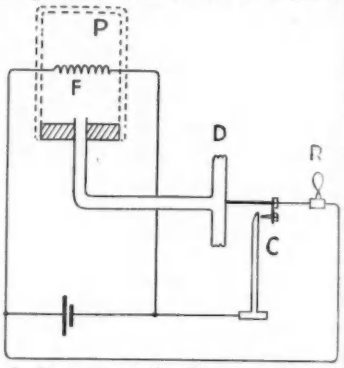
The "Edison" model J cap lamp (John Davis & Son, Ltd.) uses a nickel-iron alkaline battery and weighs just under 4 lb. complete, giving a beam c.p. of 26 maximum. The two-cell battery is insulated from the container by a rubber sheath, which also serves to cushion it. The headpiece is of bakelite and is fitted with a switch and two-filament gasfilled bulb, the second filament being for emergency use if the other burns out.

Gas Detection

The most powerful argument against the all-round use of electric lamps underground is their inability to test for gas. Under the Coal Mines Act a fireman is compelled to carry a flame safety lamp for examining during his statutory inspections. A flame lamp must also be used in conjunction with electrical apparatus in order that the operator may cut off power if gas appears. The advantage of this latter proviso is often lost, since many motor drivers are lads of sixteen or seventeen who have never been trained to test for gas. In any case, unless a definite test is made with lowered flame, as much as 2 per cent. of firedamp may easily pass unnoticed.

To overcome these difficulties various types of gas alarms have been invented; the most practicable I have found so far is the Ringrose detector. In this device a standard electric hand lamp is combined with a red bulb which lights up automatically when a predetermined percentage of methane is present. In the most modern type a relay is incorporated which maintains the red light when once lit by gas. A press contact enables it to be extinguished *if the gas has dispersed.* The detector is robust in construction, has been tried out well in practice, and is approved for general use underground by the Ministry of Mines. It is not intended to supersede the routine tests for gas made by the fireman with his flame lamp but to supplement them, and it is, of course, always at work. It is generally set to operate at 2½ per cent. methane, the amount at which men must withdraw, and roughly half the minimum percentage necessary for an explosion to occur. For use with electrical apparatus it is set at 1¼ per cent.

In the accompanying diagram the standard accumulator fitted is used to heat a filament F enclosed in a porous pot P, itself enclosed in a double gauze. Any gas present in the atmosphere diffuses into the pot and is burnt on the filament. According to the amount present, more or less of a partial vacuum is produced. This operates the diaphragm D, which closes an electrical contact C and lights the red lamp R. A new filament must be fitted at every shift, a procedure which only takes a minute or so to accomplish. The detector has proved itself satisfactory in use; one large company in the Yorkshire-Derbyshire coal field has over two hundred at work.

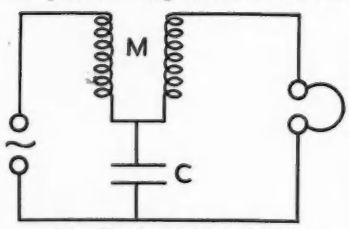


A diagram of the Ringrose detector mechanism

Measuring Very Large Capacities

An application of the Hughes bridge

THE capacities of large electrolytic condensers, which are now commercially available in sizes of from 20 to 2,000 microfarads, cannot satisfactorily be measured by the normal bridge methods applied to smaller values. The principal reasons are that the leakage current is relatively large and considerable dielectric absorption takes place. Also they are normally made for relatively low working voltages and a d.c. polarising voltage must be applied to the condenser for the period during which measurements are being made.



The Hughes bridge circuit

One or more of the above considerations will rule out the Maxwell and Anderson bridge methods, and most other bridge circuits derived from them. However, an application of the so-called Hughes bridge can be devised to take accurate measurements.

If M (fig. 1) represent the mutual inductance between the two coils, then the balanced condition, for minimum or zero current through the telephones, is reached when

$$\omega = 2\pi f = \frac{1}{\sqrt{MC}},$$

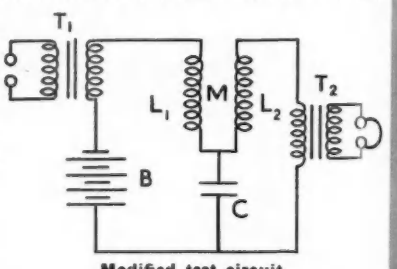
the units being radians per second, cycles per second, henries, and farads.

To apply this bridge method to the measurement of large capacities, the circuit is modified, so that C is the electrolytic condenser to be measured, B the battery supplying the polarising voltage, and T_1 T_2 are suitable input and output transformers, respectively; these transformers will, in general, have sufficient resistance to limit the d.c. flowing round the circuit to a reasonable value. The voltage of the battery B must be greater than the peak value of the alternating voltage applied to the condenser under test. It is by no means necessary for the battery voltage to be equal to the voltage rating of the condenser.

The *modus operandi* is to apply a low alternating voltage to the primary of T_1. This can conveniently be obtained from the mains by means of a potential-divider, or a step-down transformer. A frequency of 50 cycles per second is very suitable. The mutual inductance M is then varied by altering the relative positions of the coils L_1 and L_2, until the minimum or zero sound is audible in the telephones. In effect, the bridge is balanced at this frequency by adjustment of M.

The coils L_1 and L_2 are then clamped or left in this position, and a standard adjustable condenser having a range up to about 5 microfarads is substituted for the electrolytic condenser. The mains supply is disconnected, and a supply at about 1,000 cycles per second is substituted. As it is important that the frequency be known with some accuracy, a multi-vibrator controlled by the mains is the most satisfactory source. If care is taken, however, reasonable precision can be attained with a valve oscillator, a microphone hummer, or even the commutator-ripple from a d.c. generator.

A convenient method of calibration is by aural comparison with a tuning-fork of nearly the same pitch; by counting beats, an accuracy of one-tenth of one per cent. can be achieved in this way. The standard condenser is then adjusted until the balanced condition is attained at the new frequency. When this condition exists the capacity of the unknown electrolytic condenser is 400 times that of the standard, assuming that frequencies of 50 and 1,000 cycles per second have been employed.



Modified test circuit

The proof of this is as follows: Let M = the mutual inductance of coils L and L, f_1 = frequency at which electrolytic condenser is balanced, f_2 = frequency at which standard condenser is balanced, C_1 = capacity of electrolytic condenser, C_2 = capacity of standard condenser. Then

$$\omega_1 = 2\pi f_1 = \frac{1}{\sqrt{MC_1}} \quad \text{or} \quad 4\pi^2 f_1^2 = \frac{1}{MC_1}$$

$$\text{also} \quad \omega_2 = 2\pi f_2 = \frac{1}{\sqrt{MC_2}} \quad \text{or} \quad 4\pi^2 f_2^2 = \frac{1}{MC_2}$$

$$\text{Therefore} \quad 4\pi^2 f_1^2 C_1 = \frac{1}{M} = 4\pi^2 f_2^2 C_2$$

$$\text{Therefore} \quad f_1^2 C_1 = f_2^2 C_2$$

$$\text{or} \quad \frac{C_1}{C_2} = \frac{f_2^2}{f_1^2} = \left(\frac{f_2}{f_1}\right)^2 = \left(\frac{1000}{50}\right)^2 = 400$$

Therefore $C_1 = 400\ C_2$.

For the highest accuracy, it is desirable to substitute for the telephones an Einthoven or other tuned galvanometer, which will enable a very sharp minimum to be obtained. Similarly, for such work a harmonic generator is essential, since, although the frequencies applied may be unknown within limits, their ratio is known exactly, and any inaccuracy which might arise from this cause is eliminated.—G. E. R.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Comparing Heating Duties

In your issue of October 19th Professor S. Parker Smith gave data on the cost of heating an all-electric house. For comparison of costs as to the actual heating duty involved in such cases it would be useful to have an estimate of the summation of average difference between indoor and outdoor temperatures multiplied by the number of days in any given period. This is known briefly as the degree-days heating duty of any installation.

I kept fairly close record of such temperatures during two winters for the purpose of checking the heating demand of one seven-roomed house in Toronto. For the winter season September 15th, 1932 to April 30th, 1933, the degree-days duty was estimated as 6,339 with the house at 68° F. The season of 1933-34 was much more severe and a similar estimate from September 27th, 1933, to March 31st, 1934, was 7,535.

It would be interesting to compare these figures with the corresponding values pertaining to the installation investigated by Dr. Smith.

W. B. BUCHANAN.
Testing Engineer,
Hydro-Electric Power Commission of Ontario.

Toronto, *December 10th.*

"Safety at the Hairdresser's"

We have read the leaderette bearing this title in your issue of December 21st, and while we agree in the main with your contention, we feel that it is only fair to our firm to point out that for a great number of years we have consistently endeavoured in every way to render the apparatus used by the hairdresser as safe and as efficient as possible. To this end we have always insisted on the whole of our apparatus being earthed.

Eighteen months ago we produced and put on the market the first all-bakelite hood dryer. This drier is perfectly insulated by the use of bakelite mouldings in every possible place, the motor is mounted on rubber insulating bushes, and the whole stand is also efficiently earthed.

We have also just recently developed and produced a permanent-waving machine which is working on 10-V per element. This machine is provided with heating elements which are entirely non-metallic, and is fitted with a 5-A fuse across the live pole which also carries a 15-minute time switch, and the whole apparatus is again efficiently earthed.

Our biggest trouble has always been the lack of care and attention paid by the hairdressers themselves to the apparatus when they receive it, and to this end we have spent many thousands of pounds during the last few years in servicing our own apparatus in hairdressers' establishments. In connection with this service we have been astounded at the manner in which some of the machines are kept, and we ourselves think that it is quite time that some definite step was taken to ensure that the people concerned keep electrical apparatus in a manner which will ensure that it is at all times safe and efficient.

As it is, at the moment there are many firms putting cheap apparatus on the market which are in themselves a positive danger, and although we spend much money in research and take every possible precaution, we gain no benefit except the satisfaction that the work is well done.

EUGENE, LTD.
R. J. Knowles,
Works Director.

Hendon, N.W.9, *December 28th.*

Lift Control

Mr. G. O. MacMillan, in his comments on the recent article on a.c. lift control, appears to have missed the point in the use of d.c. for magnet operation on this type of panel. In the first place, he says that "with properly designed a.c. magnets there is practically no hum, and far less rattle." Surely the ideal panel should be noiselessly efficient. To what rattle does he allude?

Writing from many years' practical experience with the type of controller illustrating Mr. Woodiwiss's article, I can assure Mr. MacMillan that unless something has worked loose there is definitely no rattle, and there is, of course, no hum. Under operating conditions, when the energising switch is closed, the magnet pulls up and the contact goes home with a clean snap. This is the only operating noise and even this is in general less with d.c. on account of lighter mechanism. The point regarding the breaking of the weld does not arise, since this must be affected to precisely the same degree whether the magnets are operated by a.c or d.c.

I think Mr. MacMillan has missed the point regarding the preference of Mr. Woodiwiss for d.c. magnets. An a.c. magnet will take a heavy current if the armature is not allowed to go quite home, whereas with d.c. operation the current taken is sensibly unchanged. Hundreds of a.c. coil failures, with higher consequent maintenance costs and delays, have been caused by foreign matter, *e.g.*, copper blobs, preventing the completion of the iron circuit. This is the fact to be considered here, not the breaking of a weld, or the inductive voltage rise, or the burning. The last two points have been commercially recognised and countered for years in general contactor practice.

Has Mr. MacMillan any ideas with regard to his "light acting selector relays" for the motor control that justify the use of "could be used" in this sentence; or does he mean "would be used" (if available)? Has he ever thought of the number of movements made by the contactors, relays, rheostats and interlocks in an hour's running in a modern office block? A light acting selector relay would still have to operate contactors that carry the main motor current, and they could not be made much lighter than they already are, else the conditions for proper spring pressure on each contact horn and insulating copper section of contacts, the wipe, and the mechanical interlocking arrangements could not be met.

Mr. MacMillan's ideas for correct starting gear and braking are now practically obsolete owing to complication and expense, together with higher maintenance costs. The d.c. magnet is preferable, because it is quieter. There is definitely no rattle or hum, it has simplicity and reliability, lighter construction, and freedom from the burn-outs consequent on incomplete operation of the a.c. type. With the a.c. type use has to be made of laminated details, a more massive construction, and shaded poles. It is also noisier due to some hum, and the chances of rattle are increased.

A point so often overlooked in questions of this nature, and consequent discussions, is that of maintenance and the customer's point of view, and in the long run these have the final word. Nothing irritates a customer more than repeated or unexpected claims for maintenance replacements and breakdown delays.

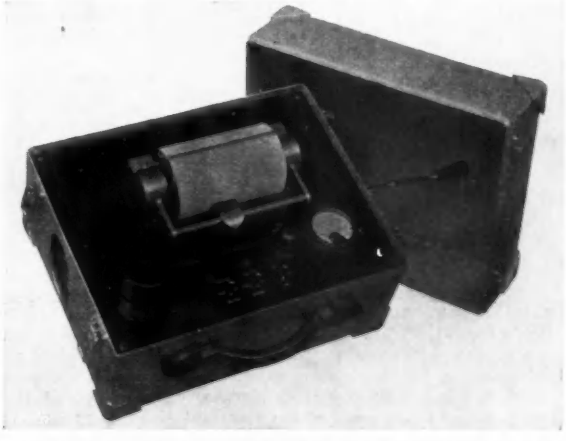
H. E. JOHNSON.

London, S.E.1, *December 18th.*

The Boiling Plate Question

The value of Mrs. Rayner's opinion on the subject of transformer-operated open type boiling plates is somewhat discounted by inaccuracies in her letter published in your issue of December 21st.

She claims to have tried various makes during the last fifteen years. There is, of course, some misunderstanding here, because not until 1928 was a plate of this kind placed on the market. The Revo "Superspeed" plate, invented by Mr. Howard himself, was exhibited first at the Bath I.M.E.A. Convention in that year and despite adverse criticism at the time on the score of initial cost it forged ahead in popularity. Early this year it was joined by the Creda "Lightning" plate; and one can only think that the supply engineers who are hiring these plates have been sadly misled or that Mrs. Rayner has "discarded" the plate without thorough investigation. Reference to a later statement in her letter leads one to the latter conclusion. She states: "It is difficult to understand why this particular plate should give higher efficiency with *ordinary* utensils, as these become distorted, and the heat



The Western Electric reverberation meter exhibited at the Physical Society's Exhibition (see page 11) is used for determining the reverberation period of auditoriums and sound studios, while it can also be employed in assessing the coefficients of absorption of materials

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generated in the hotplate can only be transmitted by *actual contact* with the utensils."

This will come as a surprise to those who, knowing the open type transformer operated plate, always imagined that the high speed of boiling was attained by *radiant* heat, no contact with the plate being necessary. Fortunately this is a fact and because of it flat bottomed pans are not by any means essential. Undoubtedly Mrs. Rayner is measuring this type of plate with the enclosed type yardstick and possibly a few pros and cons will not be out of place.

It is generally agreed that flat-bottomed pans are indispensable if the best results are to be obtained from enclosed type plates. This being so it is not sufficient to possess a flat-bottomed kettle; the user should have a complete set of utensils, including a frying pan (for pancakes, etc.), saucepans, steamer and porringer. In cast iron these will cost the better part of £2 and in aluminium £3. Having now been fitted up the user must be taught to keep both plate and pan bottoms clean or dirty contact will defeat the object of the machined utensils.

With the transformer plate, on the other hand, any old pots and pans may be used without detracting from speed and efficiency, and the blacker the bottoms the better the results! The plate will cost £3 net extra (which compares favourably with the set of special utensils) and it will boil small quantities quicker than the enclosed plate. It also glows red hot and can be reduced to a simmering heat of only 300 W instead of the usual quarter load.

In reliability there is little to choose between the two types. The former is guaranteed for two years and the latter for three, but when both have ultimately failed the former is scrap, whilst the latter has 90 per cent. of its original value (the transformer, etc.) as good as new. Both are susceptible to misuse, *i.e.*, over-voltage, the use of asbestos mats, the heating of flat irons, etc. In the matter of cleaning, does more than one housewife in five really trouble to wipe and grease the surfaces of enclosed type plates? I hold no special brief for the "Lightning" or "Superspeed" plates, but having a somewhat intimate knowledge of the type I cannot help feeling that Mrs. Rayner has discarded it after little or no real investigation. STANLEY F. BICKELL, M.I.E.E.

Liverpool, *December 21st.*

The first paragraph of Mrs. Dyson Rayner's letter in your issue of December 21st reads as follows:—

> "I agree with Mr. Howard that the transformer-operated open type boiling plate is reasonably fool-proof and does provide visible heat, but after trying various makes during the last fifteen years I discarded it for various reasons."

I cannot reconcile this statement with the fact that transformer-operated open type boiling plates have been on the market only a little over five years. Practically the whole of her letter suggests to me that she is confusing the ordinary open type plate with the transformer-operated type.

I therefore advise her to obtain some experience with a Revo "Superspeed" boiling plate; until she does her opinion as to its merits in comparison with other types of boiling plates is of little value. ARCH. J. HOWARD.

Taunton, *December 24th.*

The E.D.A. Films

As a result of reading the further letter, dated December 14th, from "Food for Thought," in reply to mine published in your issue of that date, I am led to conclude that he has given himself insufficient time to digest the "food for thought" which I offered for his palate prior to writing to you again; otherwise I think a number of his statements, in addition to the one dealt with in your footnote, would not have been made.

Like "Food for Thought," I have no desire to enter into a long controversy; as a matter of fact, I would not have entered into any controversy whatever with an anonymous person but for the facts that I am chairman of the Committee of the Area of an Association in which he states his undertaking is situated; that this Association has probably been prejudicially affected by his first letter to you; and that by some his remarks may possibly have attached to them much greater weight than would be the case were the writer's identity generally known.

I cannot agree with him that my suggestion that he should state his name and that of his undertaking is not relevant. He suggests that I should confine myself entirely to the question of the suitability or otherwise of the films. This I am not prepared to do for two reasons: First, that I wrote my previous letter mainly for the purpose of pointing out that however bad the opinion of the representative of any member of E.D.A. might be, there were methods within the Association's constitution which were open to him by which the films could be criticised as severely as he desired with possible advantage both to the member and to the Association; it was, therefore, unnecessary and disloyal to decry the work of the Association in the columns of a well-read journal, and thereby risk lowering the Association's prestige and reducing its income. Secondly, I do not claim to have the necessary experience to be able to judge of the likely reaction of films on audiences, and, therefore, I cannot say whether the films are satisfactory or otherwise until the test mentioned in my previous letter is made, namely, the way in which they are received by the public for whom they are designed.

I leave your readers to judge whether or not my previous letter could be regarded as implying that "Food for Thought" had never seen a film in his life. I certainly had no intention of making such an implication, as I thought it possible, in view of the very definite opinions expressed in his first letter—to the effect that the whole productions wanted "fading out" and that a large sum of money had been wasted on them—that he must have had much experience in connection with films or he would not have ventured to condemn the films so confidently and severely. As, however, it now appears that he bases his knowledge of the reaction of the films in question on comments made by members of the audience at the preview in Leeds, who were persons intimately concerned with the control of electricity supply undertakings, I can only conclude that he does not know how far the films are likely to be successful with the general public.

When suggesting that I should leave out the question of "status," "Food for Thought" appears to infer that I consider "status" should be judged on the basis of the size of an undertaking. Such, however, is not the case. It is, of course, possible that, as stated by him, "any engineer of however small an undertaking may have contributed equally as well to the supply industry in general and to E.D.A. as those in charge of larger undertakings," but he gives your readers no opportunity to judge how far this would apply in his own particular case.

It is true that "the river is made up of many little streams," but it is very necessary that the latter should be kept within their proper channels, as the damage any one of them can do when it deviates from its proper course is far greater than the good it can possibly do by remaining there.

THOS. ROLES,
Chairman, Mid-East England Area Committee, E.D.A.

Bradford, *December 31st.*

During the week ended Friday, December 21st, the E.D.A. films were shown to eighteen audiences in this town and rural area. Since then we have received many inquiries from engineers as to the success, or otherwise, of the films. It may be of general interest to state the effect in this area.

The films were shown to one audience of men only, and did not appear to maintain their interest. In the remaining cases they were shown either to mixed audiences or ladies only. In each case they were well received, the interest was maintained to the end, and the head of the organisation expressed great appreciation.

A further showing of the films is to take place during the last two weeks of January, limited to twenty-five audiences. These were booked during the week that the films were showing, and the demand exceeded the number of shows allotted. We have already received requests in excess of our contract for seventy-five existing audiences, and have decided to increase the number. The population of the area is 56,000.

Lancaster, *December 31st.* GEO. C. MILNES.

The Six-hour Shift

Although trade is improving gradually, increasing mechanisation and improving industrial efficiency are keeping up the unemployment figures. How can we arrange things so that both the present and potential unemployed shall be absorbed into industry, and allowed to do their share of the nation's work? It is not merely a technical problem, nor is it solely an industrial one. It is a great, human problem which challenges modern civilisation. It can and must be solved.

While the many remedial schemes, mostly involving public works and new industries, that have been put into operation (together with the shortening of total hours of labour, as recently exemplified at Boots' factories) have prevented the unemployment figures from rising, they are merely neutral measures. The solution demands a drastic change of view and corresponding action. The vital fact is that under present conditions there is not enough work to go round.

No longer can we allow from 10 per cent. to 20 per cent. of our workpeople to exist in enforced idleness while the remainder work hard from seven to ten hours daily. Work and wages, labour and leisure, must be shared more equitably. Where industrial conditions permit hours of individual labour must be reduced and extra shifts of workpeople introduced. This principle of sharing, in spite of all managerial protests to the contrary, can be applied successfully to most industries where the work is impersonal.

The principle has already been applied successfully and, in

fact, is essential to all industries involving continuous working. The prosperous industries must help to solve the common problem. Of these that of electricity supply is an outstanding example.

Although the electricity supply industry is a commercial enterprise, subject to plain economic facts, it is, nevertheless, a favoured industry. It is an essential service; it is prosperous and progressive; and its future is assured. It is thus in an especially favourable position to set an example by introducing the six-hour shift.

By taking this step it would increase shift employment by one-third almost immediately, involving a reduction of 25 per cent. in working time. The only problem to be solved is that of wages. The following assumptions present the scheme in the most unfavourable light from the employés' point of view. Possible objections from those who have the power to introduce or veto the scheme have, therefore, been reduced to a minimum.

As the employers would be unwilling to pay more for the total shift work performed, the rate of pay would remain constant, and wages would be reduced unless the Government agreed to subsidise wages with the money formerly paid to the unemployed man. Wages under the eight-hour shift system range from £3 to £6 per week, and the following table compares conditions under the old and the new systems, on the assumption that the subsidy is distributed equally without regard to the rate of pay.

Original wages per week.	New wages at normal rate (three-quarters).	Wages with subsidy (7s. 6d.).	Decrease in total wage.	Increase in hourly rate.
£	£ s. d.	£ s. d.	per cent.	per cent.
3	2 5 0	2 12 6	12.5	16.6
4	3 0 0	3 7 6	15.3	13.0
5	3 15 0	4 2 6	17.5	10.0
6	4 10 0	4 17 6	18.6	8.5

Total wages have been reduced, but even in the most unfavourable example a substantial increase in the hourly rate is shown. Is it too much to hope that the Government and the electricity supply industry, in view of the actual and psychological benefit to the nation of such a scheme, would agree to increase wages by a small amount (2½ per cent. each, say) and so lighten the sacrifices which those already engaged would be called upon to make?

That such a scheme is needed is beyond all doubt. Let the powerful, prosperous electricity supply industry set an urgently needed example. L. J. GOLDSWORTHY.

Oxford, *December 30th.*

The Torque of an Electrical Machine

In his article in your issue of December 28th Dr. E. Hughes asks: "If the torque were due to the kind of flux distortion usually shown, why should a machine still exert the same torque after being fitted with a compensating winding to prevent that distortion?"

A simple answer to this question is that torque is not caused by a distortion of the magnetic field. As the average value of the torque per ampere is equal to one-tenth of the average value of the angular rate of change of linkages this torque remains the same so long as the flux per pole is unchanged. When this is so the provision of a compensating winding cannot affect the value of the torque. C. HARGREAVES.

Bradford, *January 1st.*

Earth Leakage Protection

The increased protection of life and property by the adoption of earth leakage protection, strongly advised by Mr. T. C. Gilbert during the last few years, has resulted in the British manufacturers designing earth leakage protective circuit-breakers at a price fairly competitive with that of the Continental product.

I had an opportunity of inspecting various makes of this type of switch at a recent meeting of the Association of Supervising Electrical Engineers, when Mr. T. C. Gilbert discussed and demonstrated earth leakage protective schemes. The mechanism of the circuit-breakers was of a rather complicated and sensitive construction, this no doubt being due to the low VA consumption of the earth leakage operating coil which trips the c.b. by direct operation of the mechanism. The use of such "delicate" switchgear may in many cases result in serious difficulties and troubles to the consumer, especially when these are installed in areas where a competent electrician is not available to repair possible, if not probable, mechanical defects. Under such conditions various methods will be employed to cut the c.b. out of commission to maintain the supply of current with the possibility of serious results, as in some cases no other form of earth protection may exist on the system.

My experience with the heavier and more robustly designed switchgear has proved that the maintenance of switchgear in service is essential, and therefore a serious matter in the case of this new type of sensitive circuit-breaker.

I would suggest that the earth leakage breaker should supplement the more robust main switch-fuse and not supersede it as recommended by some of our manufacturers at the meeting.

South Tottenham, *December 20th.* H. SWIES.

Old, but Useful

I am sending a photograph taken during a recent excavation in Portland Street, Manchester. The conductors shown are ½ in. by 1¼ in. solid copper bars supported on porcelain insulators, themselves carried on an iron bar cemented at each

Ancient conductors excavated in Manchester

end into the sides of the concrete duct which is about 1 ft. 6 in. by 2 in. cross-section.

Portland Street, Manchester, was one of the very first public thoroughfares in this country to be lighted by arc lamps, centrally suspended.

It is a matter of considerable interest that in so large an undertaking as that of the Manchester Corporation Electricity Department these conductors should be in service until so recent a date. D. PEDLEY.

Manchester, *December 28th.*

Temperature Curves

I have read with interest Mr. Sandeman's article in your issue of December 28th, and would point out that his formula for calculating the final temperature rise was given by T. R. Rowlands in the ELECTRICAL REVIEW in 1924 (Vol. 95, p. 11), and its application was dealt with very fully in a paper of mine published in the *Journal* of the Institution of Electrical Engineers in July, 1930.

The exponential expression for the temperature rise is very attractive academically, but in practice the actual temperature-rise curve seldom agrees with the exponential curve, as confirmed by Mr. Sandeman's curves. In the above-mentioned paper, temperature rises calculated from initial portions of heating curves are compared with actual final values for a number of different cases and the possible causes of the discrepancies are examined. For electrical machines, it is found that the principal cause of these discrepancies is the difference in the heating time-constant of different portions of the machine, such as the embedded compared with the exposed portions of an armature winding, or the inner compared with the outer portions of a field winding.

Mr. Sandeman suggests that the time constant may be determined by drawing a tangent to the initial portion of the curve. For reasons too numerous to mention here this method is exceedingly unreliable. EDWARD HUGHES, D.Sc.

Brighton, *December 29th.*

Electrical Association for Women

Members of the Electrical Association for Women in London made two visits on December 19th, the first to the Princess Beatrice Hospital at Earl's Court, and the second to the distributing station which controls the supply of electricity to the hospital and district. The hospital authorities arranged for the party to see the up-to-date electrical equipment which has been installed there, including sterilisers, radiant heat and other therapeutic appliances, as well as comprehensive kitchen equipment.

Sounding the Depths

A new echo system described at the I.E.E.

A NEW system of echo depth-sounding for marine use is described in the paper by Dr. A. B. Wood, Dr. F. D. Smith, and Mr. J. A. McGeachy that was read before the Wireless Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on January 2nd.

High-frequency magnetostriction oscillators are employed to produce the sound signal which is emitted, and also for the reception of its echo reflected from the sea bed. Directional properties are given to these oscillators by means of suitable reflectors directed towards the sea-bed. The echo generates in the receiver high-frequency currents, which are amplified and passed through a chemical recorder. The motor driving the recorder also controls the instant of transmission of the sound signal so that the movement of the recording stylus is synchronised with the regular sequence of sound signals.

As usual the Christmas Lectures at the Royal Institution are proving a great draw to boys and girls and, of course, to many adults. This year they are being delivered by Professor W. L. Bragg, who is here seen explaining the nature of electricity to an absorbed audience

While the sound signal travels to the sea-bed and back to the ship, the recording stylus traverses a proportionate distance over the chemically prepared recording paper. Two stains are recorded at each traverse, one corresponding to the zero instant of transmission and the other to the instant of arrival of the echo. As the ship proceeds on its course, a continuous record is made which delineates the cross-section of the sea traversed by the ship. Good results have been obtained at depths exceeding 400 fathoms. The system is particularly suitable for sounding in very shallow water: a depth of 1 or 2 ft. can be clearly recorded.

This sensitiveness to depth in shallow water reveals in considerable detail the presence of wrecks or large rocks on the sea-bed. There are also important applications in survey work in rivers and harbour mouths where the recorder may be used to control dredging operations and to check the thoroughness with which such operations are carried out. The records were not appreciably affected by the noises made by the machinery and motion of the ship at the cruising speed of the vessels fitted. Good results were obtained in bad weather conditions, the rolling and pitching of the ship having but little effect on the record.

Choice of Position in Ships

This depth recorder has an important advantage over certain types in the actual fitting in ships. In low-frequency systems it is necessary to choose two positions in the ship separated by about 50 ft., so that the direct sound from the transmitter is prevented by the hull from reaching the receiver. The position of the receiver is further restricted because of excessive parasitic noises, such as those from the engine room, pumps and auxiliary machinery, water noises, and so on. These two conditions are sometimes difficult to fulfil. With the high-frequency magnetostriction system, however, the transmitter and receiver require no special screening. They may be mounted side by side, with no part of the hull separating them.

The system is tuned both electrically and mechanically to a high frequency above the ordinary range of frequencies of the disturbing background of noise. Consequently the two main difficulties encountered in the low-frequency system do not arise. The importance of these considerations will be appreciated when it is realised that an error of judgment in the choice of positions of the transmitter and receiver in a ship may lead to complete failure.

When the draught of the ship is great the hull provides sufficient screening for the low-frequency system if the separation is of the order of 50 ft. or more. In ships of very shallow draught, however, it becomes more difficult to provide efficient screening and the gear does not discriminate between the echo and the direct sound in shallow water. As already stated, the high-frequency gear requires no hull screening and in this respect should behave well in all types of craft. This property of the high-frequency system is a great asset.

Both the transmitter and receiver function even if flooded with water, so that the maintenance of water-tightness is not vital. Provided insulation of good quality is used on the few turns (11 or 12) of wire which constitute the winding of the oscillator, no further attention should subsequently be required during the normal life of the cables. This feature is very important in gear which may be fitted in an almost inaccessible position in the ship.

Directional Properties

The magnetostriction system may have any degree of "directionality" required. Hitherto it has been found satisfactory to use a conical beam of sound of semi-apical angle 20° or 30°. The comparative ease with which the receiver can be screened from the transmitter is due to the relatively short wavelength (about 4 in.) of the sound, and the directional properties of the conical reflectors.

Another advantage of the directional characteristic is that the soundings are taken directly, or almost directly, beneath the ship; little or no sound is transmitted sideways and the receiver is therefore insensitive to echoes from submerged cliffs or banks. In this respect also the directional beam is more discriminative of detail than non-directional types and is less liable to miss a submerged rock or a wreck. It has been urged against the directional system that it is affected by the roll of the ship and by steeply sloping banks. While it is true that some echoes may be missed under such conditions, the case is not so bad as it first appears. It must be remembered that the sea-bed is not a mirror, and that sound of short wavelength is returned to the receiver from directions other than the simple reflecting angle. Under the worst conditions of rolling the record of the bottom contour would appear as a dotted instead of a continuous line.

The paper is published by permission of the Admiralty.

* * *

The Position of Television

A survey of the present position of television formed the subject of an address to the PLYMOUTH ROTARY CLUB on December 21st by Mr. S. Gordon Monk, head of the electrical engineering department of Devonport Technical College. Mr. Monk discussed the Baird and cathode-ray systems, and said that although the B.B.C. did not expect that its television broadcasts would be useful at a great distance, Mr. W. H. Axworthy—who displayed apparatus illustrating the speaker's remarks—had been receiving them fairly successfully. The transmission of films (not objects) was not exactly a disadvantage at the moment. If a race were run at 3.30 p.m. how many people would be at home to see the race run? It therefore seemed better to take a film of the race and transmit it at 7.30 p.m. Mr. Monk said it was difficult to secure any information of the latest developments, but he believed that important progress was being made, and that the science was approaching a stage at which it seemed definitely possible to put television on a commercial basis. Replying to a question as to the maximum distance over which Baird television signals could be broadcast, the speaker said that at present the B.B.C. aimed at twenty-five miles, but it was contemplating the building of twenty-five short-wave stations in various parts of the country to relay television programmes.

Cathode Ray Oscillographs

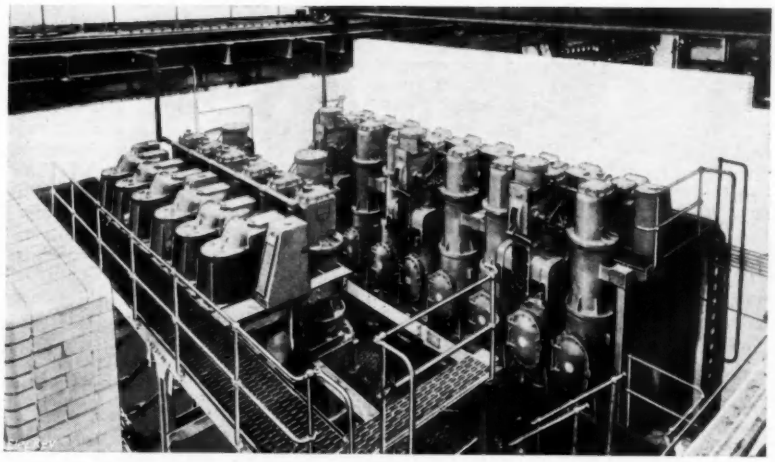
Two papers on this subject are to be presented at a meeting of the Meter and Instrument Section of the Institution of Electrical Engineers this (Friday) evening. The first, by Prof. J. T. MacGregor-Morris and Mr. J. H. Henley, deals with gas-focused types and the effects of the gas upon their performance. The other is by Prof. S. Parker Smith, Dr. C. E. Szegho and Mr. E. Bradshaw, and describes equipment embodying a high-voltage gasfilled cold-cathode tube which requires no pumps.

What Manufacturers are Doing

Metro-Vick Developments

IN any works having the varied output of those of the Metropolitan-Vickers Electrical Co., Ltd., there is always much to be seen that indicates the trend of development in the electrical industry. Recent orders for turbo-generators represent a substantial increase in numbers and aggregate capacity. Six sets are for 30,000 kW and over, all of the two-cylinder type, the largest (53,000 kW at 1,800 r.p.m.) being intended for Japan. Three of the others (33,000 kW at 3,000 r.p.m.) are for the Klip power station of the Victoria Falls Co. The 30,000-kW units for Stuart Street Station, Manchester, and for Belfast indicate what is being done in the re-equipment or extension of some of the older stations. Other recent orders for export include fifteen self-contained sets of from 200 to 5,000 kW, together with a number of generating units of larger capacity.

Frequency standardisation schemes have absorbed a large proportion of the output of induction motors of all sizes. These have included a number of winder motors. Machines of less than 300 h.p. are now being manufactured with cast-iron yokes as an alternative to welded yokes. Synchronous induction motors (of which four of 1,000 h.p. are being built for a cement works in the Far East) are being designed with automatic increase of excitation with increasing load. The 20,000-kVA synchronous condenser (the fifth) for the V.F.P. Co. is another striking exhibit.



Metro-Vick 66-kV metal-clad switchgear at the Grove Road sub-station of the London Power Co.

The cross-jet explosion-pot-contact will be found on all oil circuit breakers except those of quite small kVA capacities. An equipment for the semi-automatic control of frequency and load sharing among stations running in parallel with the grid should interest an important section of visitors. At the consumers' end of the scale is a maximum-demand leveller, which gives warning or trips off load when the total exceeds a given figure.

For the meter engineer the examples in the ranges of newly developed instruments and their transformers is impressive as well as instructive.

In the transformer section, perhaps the most notable feature is the 37,500-kVA 6.8/33-kV outdoor unit for Belfast, which is one of the largest naturally cooled transformers yet built. There are also two 75,000-kVA sets for Fulham, weighing 110 tons each. A departure from normal practice is to be found in the dry-type auxiliary transformers for the Tir John station, Swansea, ranging from 150 to 1,500 kVA. Of the smallest types, probably the most important development is the 300-VA flameproof s.p. lighting unit for mines; this occupies only about ½ cu. ft.

On-load tap-changing equipment is being incorporated in feeder boosters, sometimes with protective reactors. For inexpensive voltage regulation at consumers' terminals a self-compounding transformer is being made for use at high power factors.

There is, as usual, a number of rolling-mill equipments in hand, a novel feature of which is that bakelised bearings are employed. They are said to have from six to ten times the life of metal bearings, a lower coefficient of friction and ability to stand higher pressures. The lubricant is water with a little grease to prevent rusting. One mill-owner reports a saving of over 20 per cent. in energy consumption due to the use of these bearings.

For obviating the noise of boiler-house auxiliaries (*e.g.*, feed pumps at 3,000 r.p.m.) a line of totally enclosed fan-cooled motors up to 500 h.p. has been introduced, which reduces the loudness units by about 45 per cent. For smaller motors the textile trades are providing wide scope, particularly for the individual driving of looms.

In the field of transport, trolley-bus equipment, and mining and delivery battery vehicles are being produced, but the most novel application is that of the Pestarini metadyne to a multiple-unit train for the London Passenger Transport Board. The metadyne is a rotary transformer which converts the constant system voltage to constant current at variable voltage.

Included in the extensive work of the research department are the development of electro-magnetic and cathode-ray oscillographs, sensitive apparatus for the detection of longitudinal cracks in bars of magnetic material and investigations into the mechanism of gaseous discharges.

Recent G.E.C. Orders

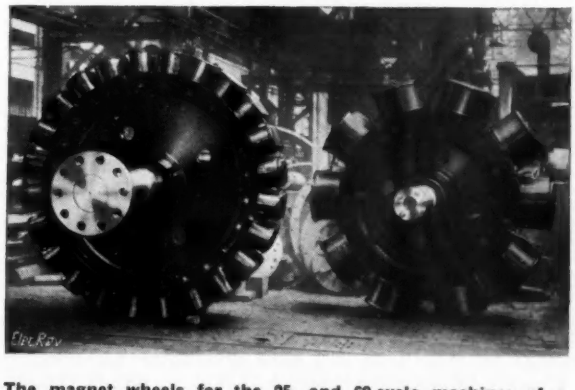
THE view that the present industrial improvement will be maintained derives support from recent experience of the General Electric Co., Ltd. Apart from the two 62,500-kW turbo-alternators for Hams Hall and a fifth 20,000-kW unit for Johannesburg there are under construction a number of smaller turbine units for industry (particularly where process steam is required) and a 1,650-h.p. six-cylinder heavy-oil engine for South Wales. Mercury-arc rectifiers are in evidence which are destined for various undertakings, in many cases for traction supplies.

Of the industrial schemes in hand, reference should be made to seven 2,500-h.p. motors for driving pulp grinders in a paper mill, each machine being equipped with a phase advancer. Winding equipments and rolling mill drives are also in hand. In the switchgear department a scheme has been devised for metal-clad switchgear where split conductor protection is provided on vertical isolation. A feature of enclosed air-break switchgear for house services is the adoption of all-insulated apparatus.

Orders for electric traction include about 230 tramcar motors for Leeds and Glasgow, forty-six 240-h.p. railway motors for the London Passenger Transport Board, and forty equipments for trolley buses at Nottingham and St. Helens. A new system of regeneration has been introduced.

In the coal washer for cleaning fine coal (below ⅛ in.) based on the company's "Chance" system, sand has been dispensed with, the coal producing its own fluid mass. This delivers coal with a moisture content of about 25 per cent., discharge water being almost free from solids. The electric winders at the Fraser & Chalmers works are intended for South Africa; most of them are being fitted with a new semi-automatic brake control gear to prevent too rapid deceleration except towards the end of a wind.

Among the many introductions for lighting, the most important of which have been dealt with already in these columns, mention may be made of the "Cleora" tubing of the



The magnet wheels for the 25- and 60-cycle machines of a 5,000-kVA frequency changer supplied by the G.E.C. to a steelworks in Nova Scotia

Claude-General Co., which converts a blue discharge into a range of sixteen colours. The "Verticable" is a paper-insulated lead-sheathed cable designed for vertical installation, *e.g.*, in lift shafts. There are also a new impregnated insulating tape, "Domestaflex" unkinkable cord and "Acmite" insulation for withstanding corrosion.

For rural automatic telephone exchanges the line-finder system, incorporating partial secondary trunking, has been evolved, and carrier current and supervisory control methods (as installed for operation recently over the h.v. lines of the Grampian Supply Co.) are being continually improved. Mention may be made of the additions to the range of measuring instruments and also to the all-insulated C. & H. meters and prepayment meters for measuring rental charges.

Newcomers in the industrial heating and cooking section are a small-scale pastry oven, steaming ovens that work at a slight pressure, and an improved vegetable boiler. Grunewald furnaces are being made for application to cold-rolled steel strip for the first time in this country, and high-frequency furnaces for cremation. Overseas requirements for domestic cookers are being met by nine new models embodying Continental-type plug-in hotplates.

Various improvements are noticeable in the radio-receivers and valves now in production, and there are several new applications of photo-electric cells. In these, and indeed in almost the whole of the technical progress of this company, as of the others mentioned, the backing of the research laboratory is evident.

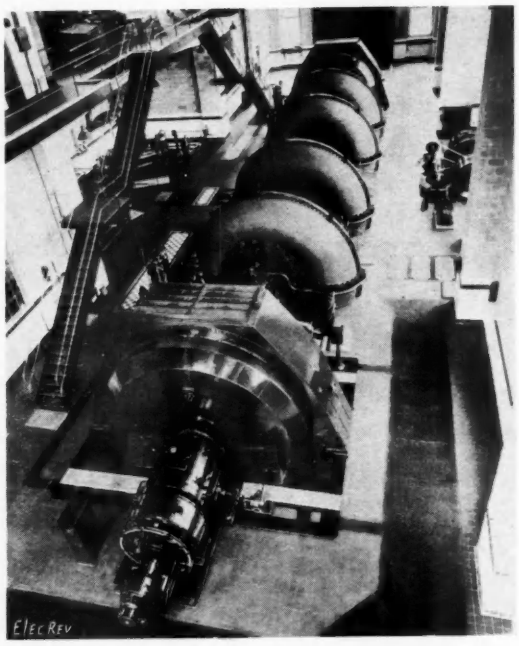
B.T.H. Activities

THE research laboratory is often the best index to the progress of an industry and this department of the British Thomson-Houston Co., Ltd., is doing important work in improving insulation and investigating the chemical and mechanical properties of materials.

In heavy plant, the outstanding order in hand is the 50,000-kW turbo-alternator for Ironbridge (West Midlands, J.E.A.) to generate at 33 kV. A second 22,500-kW set at Stourport (S.W. and S. Co.) is being reconstructed for 50-cycle operation and will also generate at 33 kV. There are also the 30,000-kW machines for Neepsend (Sheffield) and North Wilford "B" (Nottingham). A third 20,000-kVA vertical water wheel is under construction for the Grampian Power Co.

Several new lines of compound-filled switchgear, embodying round-tank cross-jet breakers of from 250,000 to 500,000 kVA at 11 and 33 kV, are under construction. A 5 in. explosion pot for a rupturing capacity of 750,000 kVA at 33kV is noteworthy as are also oil-blast fuses rated at 500,000 kVA at 33 and 132 kV.

The two 30,000 kVA 132 kV non-resonating air-jet cooled transformers for the Scottish grid are claimed to be the largest of this type so far built in Great Britain, but the largest output of any kind under construction at Rugby are the two 45,000 and two 30,000 kVA for the S.W. England area of the C.E.B., three of which will be equipped with on-load tap-changing gear integral with the tanks. The Central Board has also ordered two 33/35.2/36.8-kV 11,000 kVA step-voltage regulators.



Two 21,250-kVA, 11-kV B.T.H. waterwheel alternators for the Tummel (Grampian) station

Notable among the orders for industrial plant is that for the electrical equipment of the largest electric shovel yet built in Europe, and a number of winders driven by geared induction motors or Ward-Leonard sets for the Dominions. A sectional drive for the largest newsprint machine in the world incorporates a.c. commutator motors with an aggregate horse power of 2,000. Five 3,000-kW 11-kV motor-convertors have been built for Imperial Chemical Industries, Ltd., and three 2,000-kW 630-V rectifiers are now ready for installation at the Leicester Square sub-station of the London Passenger Transport Board. The completion of the controlled-grid rectifiers now on the stocks will bring the aggregate capacity of this type made by the company up to 25,000 kW.

Some modifications of, and new-comers to, the range of motor starters are going through the shops; these include reversing contactors for direct starting equipments, and incorporation of a series solenoid unloader in the pressure-governor switch so as to ensure that a motor is restarted against light load only. A 250-V switch for fractional h.p. motors up to ½ h.p., with two breaks per pole and thermal overload is also available. Another development is a new type of photo-electric relay which is said to be nearly ten times as sensitive as earlier examples, operating with a light intensity of about one ft. candle. Thyratrons for the control of spot and seam welding are now being built up to 700 kVA, with operation cycle counters.

Talking films and public address equipments are also an important part of this company's activities.

The Work of the English Electric Co.

THE general improvement in industrial conditions is reflected in the orders in hand by the English Electric Co., Ltd., for both home and foreign markets. Hence the increase in capacities of several of the 33-kV grid sub-stations for which the company is executing orders up to 20,000 kVA, and a raising of the voltage on some of the undertakings' systems for giving large supplies. There is also under construction a large number of small transformers for rural electrification, a great proportion being fitted with on-load tap-changing gear.

The headway being made in the application of electric welding to fabricated structures is indicated by the number of transformers and regulators being made for this purpose. Important orders are being executed for Leeds Corporation in the 6.6-kV metal-clad compound-filled switchgear rated at from 100,000 to 350,000 kVA, and for Portsmouth in h.v. and l.v. sub-station switchgear. Several of the 33-kV switch units under construction for the South Wales Power Co. are fitted with the De-ion grid arc control system.

The fuse-gear department has been extended, partly in order to deal with the demand for the new combination fuse-switch and the "Tag" high rupturing capacity non-deteriorating fuse cartridge. The number of steel-tank rectifiers ordered (one of which was the first of this type to be grid-controlled in this country) indicate progress in electrical methods of transport. In addition many glass-bulb sets are in course of manufacture.

Heavy engineering plant under construction ranges from the 30,000-kW turbo-alternator for Sheffield to 300-kW sets. Several turbines of the pass-out type have been ordered, including one of 15,000 kW, which we believe to be the largest of its kind in this country. The large order received for 70,000 h.p. of water turbines and generators for the Kendoon, Earlstoun and Carsfad power stations of the Galloway hydro-electric scheme, together with the switchgear, cables, and lighting and heating of the last two, will be conspicuous features of the shops in the early future. Another will be the 24,000-h.p. vertical reaction turbine for the Rannoch station of the Grampian Company.

There has been a notable increase in the demand for Diesels for both land and marine uses, while several Fullagar sets for the larger outputs (1,500 h.p.) are being built as repeat orders. The whole of the Diesel and electrical machinery on the first paddle steamer passenger ship on the Clyde will also be carried out by the company. Prominent in the large output of motors are the miniature capacitor machines.

Frequency change-overs are still providing a fair volume of work from the North-East Coast, Birmingham, and South Wales. Several reversing mill equipments are being built for steel works both at home and abroad.

Evidence of progress in the electrical precipitation of flue dust is provided by the h.v., d.c. generators in the shops. A range of water heaters has been added to the domestic side which has included cookers and fires for some time past. For the Southern Railway electrification, 320 motors are to be supplied for 100 train units, and for the Danish State Railways the complete control gear for thirty coaches. Tramcars and trolley buses are providing increasing work.

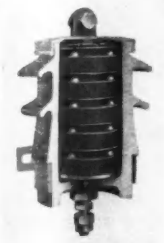
New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

New High-voltage Lightning Arrestor

The difficulty of preventing a flow of line current to the earth when an overhead line surge has been relieved by a lightning arrestor adds interest to the new high-voltage arrestor, type M.G., recently introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. It consists of a number of resistance blocks and spark gaps arranged alternately in series, the whole being housed in a sealed porcelain container provided with fixing clamps for easy attachment to transmission poles or sub-station structures.

The resistance blocks are made of a ceramic compound and the flat surfaces of the disc are metallised with copper to ensure uniform electrical contact. The resistance of the compound is a definite function of the voltage applied to it. As the voltage rises the conductivity increases much more rapidly than the voltage, and this variation takes place instantaneously, a very valuable feature owing to the steep wave fronts of voltage surges. The whole spark gap comprises a number of small air gaps in series, each gap being situated between adjacent resistance blocks and set to arc over at twice the normal voltage. This construction provides a greater breaking capacity than a single gap of equivalent breakdown capacity, and thus allows a lower value of resistance to be used.



The new G.E.C. lightning arrestor

Each gap between adjacent resistance blocks actually consists of four gaps in parallel, thus providing a high discharge capacity and an enhanced durability without risk of pitting. To reduce the time lag the gaps are formed of well-rounded domes, which give an impulse ratio of practically unity. The gap spacers consist of steatite distance pieces accurately ground and fitted in a small recess in the resistance block.

The higher the excess voltage the greater is the proportion of the current passed by the arrestor; for instance, if the voltage is doubled the current is increased about ten times, so that any surging is quickly discharged. As the overvoltage is relieved the resistance increases very rapidly; the blocks will withstand repeated discharges without overheating and will not puncture on the severest discharge. Type M.G. arrestor is available in various sizes, differing only in the number of resistance blocks and gaps, and suitable for three-phase systems (with neutral insulated or earthed through a resistance) or for single-phase systems.

Talking Apparatus for Electric Lifts

The conversion of the electric lifts at some of the stations on the London Underground railways for automatic operation has necessitated the provision of means of warning passengers to "Stand clear of the gates, please!" This is done electrically by reproducing through loud-speakers a cinema film record of the spoken words, repeating the sentence at appropriate intervals. The film is operated automatically by the lift starting mechanism. Talking apparatus of this kind, made by MESSRS. ERNEST F. MOY, LTD., Greenland Place, Camden Town, N.W.1, has functioned satisfactorily at Earl's Court, and a second outfit has recently been completed for installation elsewhere.

A warning device for lifts, (inset) the rotor

The gear is housed in a sheet-steel cubicle, the lower portion of which accommodates the switchgear, transformers, and thermionic amplifier. The upper compartment contains a synchronous a.c. motor of special design. The rotor is in the form of a large-diameter wheel, to the rim of which is clamped the film record. A ray of light from an exciting lamp shines through the sound track on the film into a photo-electric cell, by means of which the voice is reproduced. The message delivered by the loud-speakers can be modified by simply changing the film, while the addition of a microphone enables direct speech to be amplified in the event of emergency directions becoming necessary.

Foiling the Bagsnatcher

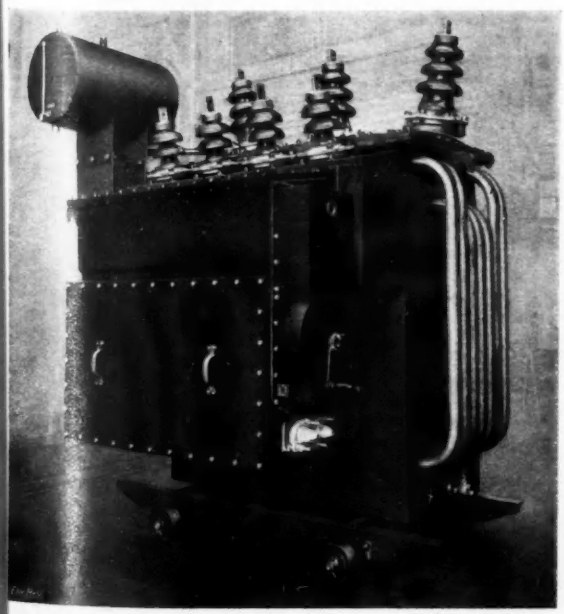
We recently witnessed a demonstration of the new alarm bag which is being marketed in this country by ALARM BAGS (GREAT BRITAIN), LTD., 35, Hatton Garden, London, E.C.1. By means of an automatic arrangement in the "alarm bag" a siren sounds should the bag be tampered with by any unauthorised person. A switch on the underside of the handle is normally compressed by the holder, and when the bag is snatched away the holder releases the switch instantly. There is also a "push-in" switch underneath the case for operating the alarm when the case is lifted from the ground. Only the person in possession of the key to the bag (each one has a different lock) can stop the alarm, which will sound continuously for three hours. The bag can be used to prevent a car being stolen by being placed on the driving seat, and it can serve the purpose of a burglar alarm in a house where it is placed against a door as tilting alone will operate the switch. The standard bag costs £7 10s.; it can, however, be made to any requirements.

The "alarm bag," showing the siren behind the grill; below, a specially constructed doctor's bag

An R.I. Radio Receiver

A new d.c. superheterodyne broadcast radio receiver has been introduced by RADIO INSTRUMENTS, LTD., Purley Way, Croydon, incorporating detector oscillator, i.f. double diode-triode, pentode, and barretter valves.

The circuit incorporates delayed a.v.c., noise suppression control and also a volume control, both manually operated; an energised speaker is used. A walnut and ebony inlaid cabinet will be standardised with the usual semi-concealed side controls and translucent station-name dial. The price is 15 gns. The new set has been tested in several notably bad d.c. areas and we are informed has given satisfaction. This d.c. chassis will also be available in "Duotone" radiogram form at 29 gns.



A 200-kVA English Electric 3-phase, 33/11-kV distribution transformer fitted with automatic on-load tap-changing gear. (See opposite page)

Refrigerator Prospects. By Ben Quarmby

An all-moulded model foreshadowed

THE progress of the domestic electrical refrigerator in this country has exceeded the most sanguine expectations. Associated educational work by advertising and the publicity given to new developments by the electrical Press have contributed greatly to the increasing popularity of these appliances, and diligent research and periodical improvements have kept the interest alive.

The early domestic models, many of which are still giving excellent service, embodied the maximum of wood in their construction. The exterior was usually of polished oak and the interior of vitreous porcelain enamel. Later models, although still made of wood, were sprayed outside with several coats of white enamel, providing a more serviceable exterior, in keeping with kitchen requirements, and permitting a slight reduction in retail prices.

This type of domestic cabinet is being superseded by the all-steel cabinet, which, however, is often still built up on a wooden frame. Some types are constructed entirely without wood as a framework; in others wood is reduced to the minimum—usually a small section to break conductivity between interior and exterior steels, and as a framework for the door panel, to strengthen top and doors, and to provide a fastening for the door gasket.

Supply authorities and electrical traders generally have responded well to the appeal for their co-operation in the marketing of these appliances, but many of them have refrained from touching electrical refrigerators and have been emphatic in their criticisms—mainly on account of prices, and have expressed their willingness to give their support when considerably lower retail prices are established.

Improved production methods, combined with a reduction in sizes, have made possible, for the first time in the history of refrigeration, a complete all-steel model of 3 cu. ft. capacity at under £30; this has received general approval, and these "minor" models have had a good market. There still remains a feeling, however, that further reductions are necessary in order to make the domestic refrigerator a really popular line with the general electrical trader and with the supply authorities in the poorer neighbourhoods.

Eliminating Steel and Wood

Ambitious plans are in hand by several manufacturers in relation to their 1935 models, in which all these requirements will be fulfilled, and a complete departure from present practice is foreshadowed which, it is calculated, will place the refrigeration industry on a completely new footing. The total elimination of steel and wood in cabinet construction will help to lower prices and reduce production costs and, particularly in relation to the smaller models, will enable many electrical firms to place their own refrigerator on the market along with their other productions without the undue expense which present methods and materials involve.

This new development, which is undoubtedly a starting point for a great improvement in design, appearance and performance of the domestic refrigerator, proposes to utilise the now well-known thermo-setting phenolic resins, with which materials a range of coloured effects of great beauty, finish and permanence can be obtained, and a completely plastic-moulded cabinet will be available for the smaller domestic refrigerators scheduled for next season.

One such design calls for a moulded cabinet of 3 cu. ft. interior capacity, in four parts only: The exterior, comprising cabinet front, top, bottom, and two sides; the interior, in one mould, arranged to fit closely around the door frame on the exterior mould, and incorporating projections to hold the food shelves; the removable back, which need not be moulded, but could be cut from sheet bakelite of a suitable thickness; and the door, which is moulded and incorporates a fixed door seal in the form of a ridge fitting closely into a recess around the door opening in the exterior mould, and eliminating the use of the separate gasket. Separate smaller mouldings for interior use include food shelves, drip trays, and various sizes and shapes of containers.

The simplicity of this construction will be immediately apparent; the fixing by a suitable cement of the interior on to the exterior eliminates all metal screws, thus preventing, for the first time in refrigerator construction, the undesirable conductance by contact of the metal connection between interior and exterior and reducing the leakage at this point.

Better Performance

The insulation value of these moulded materials will help greatly in improving the performance of a small refrigerator, and will allow a decrease of the thickness of insulation necessary for a given value. Further economy will be achieved by using a continuous unbroken layer of insulation between the moulded interior and exterior, composed of granulated cork, mixed with a suitable binder, and forced in under pressure, making a completely airtight seal, impossible with the use of compressed-slab cork with the many necessary open joints, broken corners, expensive cutting and unavoidable waste.

The complete moulded cabinet will be mounted on a one-piece chromium-plated tubular steel stand bent as required to form the four rounded legs, and a raised support for the condensing unit. Laminated coloured bakelite sheet cut to size and fitted into the steel tube in narrow slots without any holding screws whatever will complete the machine compartment and allow immediate and trouble-free removal for inspection or installation.

Operating Units and Finishes

The substantial reduction in heat leakage brought about by the use of plastic mouldings of high thermal insulation value will enable smaller cooling coils and condensing units to be employed, requiring smaller motive power to operate and thus securing economy in operating cost. It will also allow more compact units to be designed and effect a welcome economy in space utilised by the cooling unit in the cabinet interior, giving a larger effective food-storage capacity.

A domestic refrigerator in black, white and chromium will be a feature in next season's range, possessing all the attributes it is at present possible to conceive in refrigerator construction. The highly polished white interior, with the gleaming chromium of the hinges and stand and the well-designed contrasting black exterior, should be pleasing to the eye and set an entirely new style. The proposed use of dead black as a colour for exterior design is based on conclusive proof of the effects of colour in food preservation revealed by recent research, in which black along with grass green were cited as the best two colours to use as being most effective in eliminating harmful light rays which promote food spoilage; both these colours promise to become popular as exterior mouldings in refrigerator cabinet design.

As a utility refrigerator this design of cabinet promises several decided advantages. Instead of being mounted on a stand the cabinet itself could be built in anywhere, with the compressor in a remote position, and, with its reduced external dimensions for a given interior capacity, will prove an ideal appliance for the smaller modern kitchen.

Plastic Materials Available

The plastics industry to-day offers a variety of materials suitable for this work, in a range of colours and with varying thermal insulation properties, that are impervious to damp or rust and easily turned out in a completed form from the mould ready for erection and not requiring any of the various processes necessitated by steel or iron parts—bending, drilling, spraying, bonderising, welding, grinding, and the long process of baking several coats at a high temperature for hardening. The dangers from weld-decay or the warping of parts due to the extremely high temperatures required in vitreous enamelling are absent, and the time element in the costly building up of the many steel parts used in cabinet construction at present is considerably reduced.

The adoption of a plastic-moulded cabinet will result in an appreciable reduction in final cost and a reduction in those slight errors and inaccuracies inseparable from production by hand or in small quantities, providing components perfectly accurate and interchangeable, and allowing the smaller firms to reap the advantages of quantity-production methods.

Rapid developments in the plastics industry itself have made possible these larger mouldings which are destined to play a great part in the future of refrigeration. Electricity has taken a hand in these developments, for heating elements are now inserted into the body of the mould and of the plunger itself, helping to maintain an even surface temperature all around the faces of the mould, thus ensuring the necessary easy flow of the compound into all corners and interstices.

There is every indication that plastics will contribute greatly to refrigeration design and construction in the future. This will have a profound effect in all directions, improving appearance and performance, and securing that looked-for ideal, a considerable reduction in list prices. This will open up new prospects for the refrigerator to the great advantage of the electrical industry.

Water Heating Displays. By J. Russell Hickmott

Suggestions for showroom window demonstrations

WATER-HEATING equipment does not lend itself very well to window dressing with the result that especial care must be taken when attempting a display. Immersion heaters, for instance, might be anything so far as the general public is concerned unless very clear particulars as to their use are included in the window. The storage heater is a little better in appearance owing, probably, to its resemblance to a gas geyser, and no difficulty is experienced in deciding what it is. Some weeks ago I stood among the crowd outside a supply authority's showroom window and to my surprise I overheard almost a heated discussion as to what certain electrical appliances in the window were really intended for. Although some kinds of advertising take the problem form, in this case the result was unintentional.

It is not generally realised that the public has not yet become fully electrically minded and a window display must be very simple in design and clearness if good results are to be obtained from it. This does not necessarily apply to contractors' windows for, in the majority of cases, their apparatus is more widely known. There is a world of difference between a small electric fire and a hot-water circulator.

Again, water heating is overshadowed by a certain amount of prejudice and, although this is gradually disappearing, some is very obviously still left in the mind of the average consumer. How many supply authorities have dared to show the losses of, say, a 12-gallon storage heater in their showroom window? Why not fit such a heater in the window and connect it through a demonstration meter to the mains? At the side of the heater a card could show how long it had been in circuit. A display of this kind would reassure the public far more than any talk could do.

This idea could be extended still further by having another heater of exactly the same type connected through another demonstration meter showing the actual consumption under working conditions. Each day a given number of gallons of hot water could be drawn off, representing an average day's supply in an average household. A printed card could, again, show the number of days the heater had been in circuit and also the quantity of hot water drawn off each day and the reason for such a quantity.

A Glass Tank

Immersion heaters, as mentioned previously, are very difficult to show off to their best advantage. The first necessity is obviously a standard hot-water tank in which to show how an immersion heater is fitted. If it is possible to obtain a tank with one side made of glass so much the better. The tank can then be filled with water and the heater actually used; an indicator lamp connected so that it will light when the thermostat cuts in is an added attraction. Again, the demonstration meter can be used with effect. The losses from an unlagged tank can be compared with those from a properly lagged tank in a very effective way.

I have yet to see a complete hot-water installation including boiler, tank with immersion heater fitted and cold water cistern made in glass so that the circulation of the heated water could be demonstrated. There is no doubt that many consumers could be interested in water heating by such a demonstration.

An outstanding window display could be produced quite simply and cheaply by having a constantly running tap fed from a water heater, the used water being pumped back to the heater. In these circumstances the water could be maintained at a sufficiently high temperature to produce a very effective quantity of steam, thus showing how easily really hot water is obtainable. Another attractive display, utilising the pump, could be obtained by filling a bath with hot water from, say, a 25-gallon tank fitted with immersion heaters and then, after a few minutes, pumping the water back into the tank to be reheated. A large-size thermometer situated in the bath would complete the display. Although these ideas may appear rather simple it is amazing how quite simple things, providing they are in action, attract the eye.

In a window display consisting of a general scheme as outlined above and in which, unless precautions are taken, quantities of steam may be produced, care should be taken to avoid any chance of the windows becoming obscured. This may be achieved by arranging a length of tubular heater in such a way that the heat will rise up the window and prevent condensation taking place. During very cold weather the quantities of steam formed may be excessive and, in order to avoid this, the temperature of the window should be maintained as high as possible. This should not be a difficult matter in completely enclosed windows, but where the windows are open to the showroom other methods will have to be employed. Perhaps the easiest way is to arrange one or two radiant heaters so that their rays are directed on the surface of the water. These heaters can be fixed in a concealed position on the ceiling of the window.

"Side-Shows"

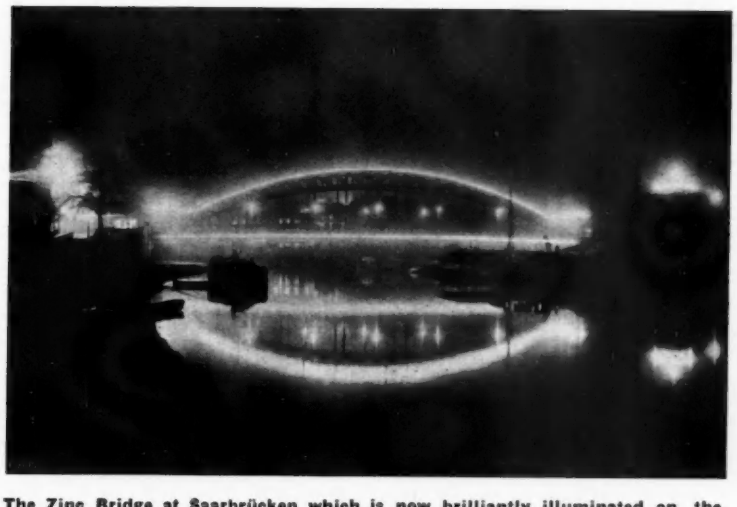
Although the displays suggested above are intended to form the main attraction in the window it is often necessary to fill in the background with what may be termed "side-shows." In many cases this is done with some of the smaller appliances such as portable fires, toasters and irons. Unless these are very carefully arranged they are likely to spoil the effect of a window in the same way as too many showcards will do. There are quite a number of side-shows that can be arranged in keeping with a water-heating window display which will give really useful information to consumers.

For instance, the majority of consumers have very little idea of quantities of water and probably still less idea of temperatures. This suggests one or two really original side-shows. A bucket of water with a label attached showing the cost of heating the water it contains to boiling point; a hand-basin containing sufficient water to wash with at a suitable temperature, also labelled with the cost; or even a kettle or teapot could be introduced into the show.

When specialised window displays are being run it is advisable to allocate one showroom salesman to each subject. In the case of water heaters this is more important than ever. By this means considerable trouble is avoided owing to conflicting answers being given to consumers. These mistakes are often quite unavoidable but at the same time they cause mistrust.

Consumers, in a great many cases, do not appreciate the difference between water at 170 deg. and water at 100 deg. The fact that a high temperature makes up to some extent for lack of quantity should be carefully pointed out to them. Where possible practical examples should be given, such as the quantity of cold water that may be added to water at 160 deg. in order to bring it down to a reasonable bath temperature. A common mistake often made by consumers is that they assume that scalding water is really boiling water. The fact that there is actually 50 deg. difference should be pointed out to them.

I experienced a very striking example of this some time ago when I had occasion to reduce the setting of a thermostat. It was not until I had reduced the setting from 170 deg. to 140 deg. that any difference in temperature was noticed. This, by the way, is a very sound reason for not setting the thermostat above 150 deg. in the case of immersion heater installations where the lagging is not up to standard thickness. In any case there is no need to go above this temperature if there is sufficient storage capacity to give an ample supply at the lower temperature.



The Zinc Bridge at Saarbrücken which is now brilliantly illuminated on the occasion of the approaching plebiscite in the Saar Territory

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

The " Electrical Review " Index

The index to Vol. CXV (for the half-year ended December 31st, 1934) is in course of preparation and will be published shortly. We shall be glad to receive the names and addresses of those who require it (free of charge) for binding purposes, or wish to retain it for reference. Application should be made as early as possible to the Publisher, ELECTRICAL REVIEW, Dorset House, Stamford Street, S.E.1.

Important Plant Extensions at Liverpool

Sanction has been obtained by the Liverpool Corporation from the Electricity Commissioners to the extension of the Clarence Dock power station by the installation of four additional boilers. It is proposed to accept the tenders of Messrs. Babcock & Wilcox, Ltd., for the installation of four boilers, each having a normal evaporative capacity of 200,000 lb. of steam per hour, together with auxiliaries and steam and feed pipes, for £272,000, Messrs. Mather & Platt, Ltd., for one electrically driven lift and feed pump with a capacity of 600,000 lb. of water per hour (£2,580), and one electrically driven gland sealing pump (£182), and Messrs. Henry Simon, Ltd., for extensions to coal conveying plant (£4,160).

An Opportunity Seized

In the accompanying illustration we show a novel form of electrical propaganda which has been adopted by Mr. J. E.

A new form of electrical propaganda at Rawtenstall

Shepherd, borough electrical engineer of Rawtenstall. The posters shown have been erected by the Ministry of Health in its campaign for smoke abatement, and Mr. Shepherd has effectively added to their appeal by suggesting that electricity will solve the problem of smoke nuisance.

An Electric Furnace Agreement

The range of " Birlec " furnaces manufactured by Birmingham Electric Furnaces, Ltd., has been extended to include equipment for melting ferrous and non-ferrous metals. This follows an agreement completed between the company and the Detroit Electric Furnace Co., of the United States, for the sole manufacturing rights in the Detroit rocking electric arc furnace for the British Isles, Dominions and certain other countries.

An Electrical Contract at Preston

There was a long discussion at Preston Town Council on December 27th arising from a letter from the Ministry of Health concerning the new electrical installation at Sharoe Green Hospital. The Minister was not prepared to agree to the contract (amounting to £3,250) being executed by the Electricity Department without competitive tenders being sought. The Health Committee was of opinion that the work should be carried out by the Corporation Electricity Department, and the chairman with the chairman of the Electricity Committee and the Town Clerk were authorised to interview the Ministry of Health on the question. A reference back of the decision of the Committee was finally defeated by a majority of thirty votes against ten. Councillor Rowcroft said that in Preston they had several firms competent to carry out the work, yet they were not allowed to compete. Councillor Gordon thought a municipal undertaking should be immune from competition in matters of this sort and should not be hampered by competitive tenders. Councillor Blackburn said that the Electricity Committee was not afraid of competition, and was quite willing to compete in the open market for any work.

Boiler Construction

While a large number of boilers for land use are being constructed by Messrs. Yarrow & Co., Ltd. (many of them for the Dominions), the most notable work recently has been done in connection with installations for the Admiralty and foreign navies. Included in the latter are three water-tube boilers with steam conditions of 400 lb. per sq. in. and 700 deg. F. to be supplied for a destroyer being built at Lisbon to Yarrow designs; they are similar to those provided for the two other destroyers recently built by Yarrows for the Portuguese Government. The British flotilla leader *Grenville* will be fitted with side-fired boilers of the type used on the *Queen Mary* and other large liners. Twelve boilers equipped with superheaters and airheaters and mechanical retort-type stokers are being supplied for the three new Southern Railway cross-channel train ferries, two of which were recently completed.

Insulated Wire Manufacture in Palestine

The Palestine Electric Wire Co., Ltd., has been established at Haifa, with a capital of £25,000, to manufacture insulated wires for electrical installation and kindred purposes. The company is under the management of two German Jewish engineers, Messrs. A. Broide and A. Rosenberg.

Coiled-coil Filament Lamps

On October 12th we commented on the production of the first 60, 75, and 100-W coiled-coil lamps. These are now on the market in pearl, opal, and clear bulbs and the average life is given as 1,000 hours. Double coiling the filament (which is less than 0.001 in. in diameter) reduces the coiling effect of the inert gas, enabling a larger filament to be used to provide additional light, which is stated to be 20 per cent. with the 40-W size, 15 per cent. for 60 W, 12½ per cent. for 75 W, and 10 per cent. for 100 W. A change from ordinary gas-filled lamps by the five million domestic consumers would thus provide 3,000 million additional lumens without extra cost of energy, apart from the saving for large buildings and

Power Station Staffs' Salaries

A REVISION of the salaries payable to the staffs of electricity supply undertakings is announced by the National Joint Board of Employers and Members of Staff (Electricity Supply Industry.) The new rates of pay (shown below), which come into force as from January 1st, are based on the average cost-of-living figures for the past six months and represent 16 points of deduction (against 17 for the period now ending) from the basic rates in the schedule of 1923. Employés in the London area are entitled to an addition of 5 per cent. to the schedule rates. In any district where conditions justify lower remuneration a deduction of 5 per cent. can be made by mutual agreement.

Title of Grade.	Grade.	Class A 1,000— 2,000 kW.	Class B 2,001— 4,000 kW.	Class C 4,001— 6,000 kW.	Class D 6,001— 8,000 kW.	Class E 8,001— 13,000 kW.	Class F 13,001— 25,000 kW.	Class G 25,001— 50,000 kW.	Class H 50,001— 100,000 kW.	Class J 100,001 kW. and over.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Deputy Chief Official	1	461 6 0	495 8 0	543 14 0	574 0 0	—	—	—	—	—
	2	397 18 0	427 5 0	469 17 0	497 6 0	538 19 0	—	—	—	—
Power Station Supt. Mains Supt. (with charge of sub-station).	3	356 5 0	382 15 0	423 9 0	447 2 0	485 19 0	505 16 0	543 14 0	586 6 0	645 0 0
Mains Supt. (without charge of sub-station).	4	303 4 0	337 6 0	360 19 0	396 0 0	429 3 0	448 1 0	496 7 0	530 9 0	574 0 0
	5	285 5 0	309 17 0	341 2 0	361 18 0	392 4 0	424 8 0	442 8 0	486 18 0	516 5 0
	6	256 17 0	287 2 0	307 19 0	337 6 0	355 6 0	384 13 0	412 2 0	440 10 0	483 2 0
	7	230 10 0	256 17 0	287 2 0	303 4 0	329 15 0	356 5 0	370 9 0	410 4 0	433 17 0
Shift Charge Engineer	8	230 10 0	230 10 0	256 17 0	282 8 0	297 11 0	323 2 0	345 16 0	359 1 0	394 2 0
	8a	214 0 0	214 0 0	234 9 0	256 17 0	273 17 0	297 11 0	319 6 0	334 9 0	364 15 0
Sub-Station Charge Engineer ...	8b	198 5 0	198 5 0	216 7 0	232 17 0	250 4 0	272 18 0	292 16 0	310 16 0	336 7 0
	9	—	—	198 5 0	212 8 0	228 19 0	248 6 0	267 5 0	287 2 0	307 19 0
Switchboard Attendant	9a	—	—	—	198 5 0	213 4 0	221 17 0	235 5 0	254 0 0	275 15 0
	10	—	—	—	—	198 5 0	198 5 0	209 5 0	223 9 0	244 10 0
	10a	—	—	—	—	—	—	198 5 0	212 8 0	228 3 0
	10b	—	—	—	—	—	—	—	198 5 0	212 8 0
	10c	—	—	—	—	—	—	—	—	198 5 0

NOTE.—The percentage increases and decreases provided for in Clauses 37 and 38 respectively should be calculated upon the above figures.

industry. Expenditure by members of the Electric Lamp Manufacturers' Association on research to procure high quality lamps exceeds £100,000 per annum.

Contractors and Municipal Showrooms

The borough electrical engineer, Birkenhead, has been authorised by the Electricity Committee to ascertain from the contractors, for the information of the Committee, the reasons for the small measure of business placed by them with the Corporation showroom in connection with consumers' requirements. This is the sequel to the questions asked at the last meeting of the Council as to why electrical contractors who received contracts for Corporation work did not know their terms of contract, which stipulated that as much business as possible should be placed with the showrooms. It was stated that the showroom received a negligible proportion in relation to the contract amounts.

Diesel-electric Paddle Steamer

The complete propulsion equipment for the Diesel-electric paddle steamer *Kenilworth* (to which reference was made on page 734 of our November 23rd issue) now being built by Messrs. A. & J. Inglis, Glasgow, for the London and North-Eastern Railway Co.'s Clyde service, is being manufactured by the English Electric Co., Ltd. The main propulsion equipment will consist of four 400-h.p. Diesel engines, complete with generators and exciters, and while these generating sets will be specially arranged with a view to avoidance of noise and vibration, there is no intention as was originally stated of mounting them on springs for this purpose. The main paddle motor will be of the double armature type, designed to develop its full power at approximately 50 r.p.m., and the main paddle shafts will be connected by special couplings to either side of the propulsion motor. Although a motor of this type would permit of individual drive for the port and starboard paddles, in the case of this particular vessel a solid drive is to be employed, so that either half of the double armature motor can transmit power to both paddles. The space occupied and weight of the Diesel-electric machinery are claimed by the makers to be appreciably less than those required for reciprocating steam engines and boilers of similar power.

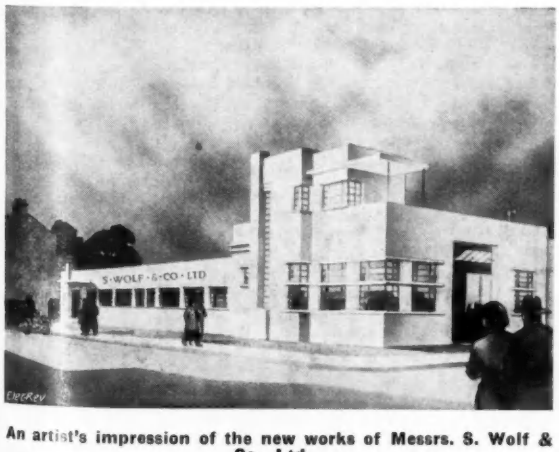
Recent Contracts

International Combustion, Ltd., has received the order covering the dust and grit disposal plant for the extensions to the Hams Hall power station of the Birmingham Corporation Electric Supply Dept.

The English Electric Co., Ltd., has secured a contract from the London, Midland and Scottish Railway for ten Diesel-electric shunting locomotives, each of 300 h.p. This type of locomotive is said to be the first Diesel-electric shunting locomotive to be built entirely to British patents. The ten locomotives will be constructed in conjunction with Messrs. Hawthorn, Leslie & Co., of Newcastle-on-Tyne, who will supply the mechanical structure, the English Electric Co. supplying the Diesel engines, generators, driving motors and control equipments, all of which are of the company's own design and manufacture. Construction will be undertaken immediately and will give full-time employment for ten months in a number of sections of the company's works at Rugby, Stafford and Bradford.

New Electric Tool Works

New works are being constructed at Hanger Lane, Ealing, W., for Messrs. S. Wolf & Co., Ltd. The building will be



An artist's impression of the new works of Messrs. S. Wolf & Co., Ltd.

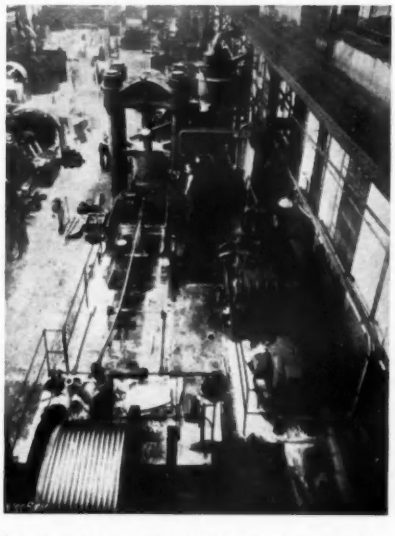
of modern design and will cover 20,000 sq. ft. with space for extensions. The new works are of the single storey type, constructed in ferro-concrete and brick. The frontage will be occupied by the executive offices, a large area being provided for an up-to-date showroom to display the comprehensive range of electrical tools manufactured by the company and the many machine tools which it handles. The factory will be at the rear and will be laid out for flow production. The facilities planned will enable the company to produce many times the present number of electric tools. It is anticipated that the transfer to the new works will take place in February, and in the accompanying illustration we reproduce an artist's impression of the new premises.

The R.A.C.S. Mitcham Dairy

Reverting to our article on this dairy which appeared in our issue of Dec. 21st, we are asked to make it clear that the Royal Arsenal Co-operative Society's Engineering Department, under the management of Mr. S. Aldred, was responsible not only for the electrical equipment but for the entire layout and installation of the plant.

A New Lead Press

A new lead press has recently been installed in the works of Derby Cables, Ltd., at Derby. The press exerts a total pressure of 3,000 tons on the ram, or 33 tons per sq. in., the pressure being supplied by a three-throw hydraulic pump driven by a 100-h.p. Crompton Parkinson motor. The furnace is heated by oil fuel, the feed being thermostatically controlled to maintain the correct temperature. By special arrangements in the furnace, lead entering the container of the press is kept absolutely free from oxide, dross or other contaminations. The die-box is electrically heated, the 20-kW heating load being supplied by a Crompton autosynchronous motor-generator set. The die-box temperature is registered by thermo-couples placed at eight different points Special arrangements are incorporated in the design to ensure accurate winding on and off the drums at the correct speed. The rotation of the haul-off drum is automatically controlled by a self-adjusting variable speed drive, the cable being fed in at the back of the press at the same rate, and similarly controlled. In this way the production of a flawless lead sheath is ensured.



The new lead press at the works of Derby Cables, Ltd.

A New Refrigeration Company

Messrs. Haslam & Newton, Ltd., have made provisional arrangements for the sale on January 1st of their refrigerating undertaking to a company to be formed under the name of the Haslam Foundry & Engineering Co., Ltd., or other similar name. The new company is being formed in conjunction with Messrs. L. Sterne & Co., Ltd., refrigerating engineers, of Glasgow, who will direct the future control and policy of the new company, Messrs. Haslam & Newton retaining a substantial interest therein.

The electrical section including the freehold works and plant, &c., at Alfreton Road, together with the rights of the patent gear are being retained, and it is proposed to change the name of the company to Newton Bros. (Derby), Ltd., or other similar name.

An Ironmongers' Guide

The "Ironmonger Diary and Hardware Buyers' Guide, 1935," which has just been published, in addition to providing a comprehensive directory of manufacturers' trade names and ironmongers' wares contains a literary section which includes a great deal of useful matter relating to licences, patents and trade marks, postal information, &c., and a number of tables, including those for various types of electric cable.

Social Events

A gala dance by about 200 dancers of W. T. Henley's Telegraph Works Co., Ltd., was held at the Royal Hotel, Woburn Place, on New Year's Eve. Representative parties came from the Gravesend Works and Henley's Tyre & Rubber Co. The Woolwich Works was not represented owing to stock-taking. Among those present were Mr. Jacob, the company's secretary, and his daughter, Mr. F. H. Page (London representative) who had in his party Mr. Boon and Mr. Bennett, of the County of London Electric Supply Co., Ltd., and Mr. H. Stanley, of the Tyre Co. The dance was organised by Mr. S. L. Crafford, and Mr. R. K. Edney acted as M.C.

A happy and boisterous gathering assembled at the Fulham Town Hall on December 28th when 650 poor children of Fulham were entertained by the Goblin Round Table which comprises members of the staff of the British Vacuum Cleaner & Engineering Co., Ltd. During tea entertainment was provided by clowns, while among the helpers who assisted in waiting on the children were Mr. H. C. Booth, M.Inst.C.E., chairman and

managing director, Mrs. H. C. Booth, Mr. J. J. Hambidge, general manager, and Mrs. F. H. Rogers. After tea the main hall was cleared, and the children were entertained by a cabaret staged by Mrs. Vera Todd's Goblin Girls from the Palace School of Dancing, a Punch and Judy show, conjuring, singing competitions, &c. The evening was brought to a close when the children were each presented with an envelope containing a gift by Mrs. H. C. Booth, and a balloon.

In connection with their "Coming-of-age" celebrations Messrs. Ferguson, Pailin, Ltd., distributed a bonus to their old employés, as a mark of appreciation of their services to the company. A dinner and dance was also given at the Manchester Limited Restaurant on December 17th, to employés with over ten years' service with the company.

At a Christmas party on December 22nd Mr. and Mrs. Marryat entertained 850 guests, being employés of the firm and their wives and children, at the Holborn Hall. The children were treated in the afternoon to a shadow pantomime, conjuring, and clowns, which was followed in the evening by a dance for the grown ups. In the course of a few remarks Mr. Marryat congratulated the staff upon the progress of the undertaking, which he attributed largely to the thoroughness and tact displayed by departmental managers who, he noted, were mostly old apprentices of the firm.

The Connaught Rooms

With reference to the description of the lighting installation at the Connaught Rooms, W.C., which appeared in our issue of December 28th, we are informed by G.V.D. Illuminators, Ltd., that they supplied the laylighting system which is a notable feature of the Balmoral Room. There are eighteen laylights in each of which colour-changing effects are arranged with the use of one bulb only for each colour. The four colours employed—red, blue, green, and white—can be maintained at a constant value or varied by a dimmer designed by the consulting engineers, Messrs. Ridge & Aldred. The scheme was carried out to the direct instructions of the architects, Messrs. H. V. Ashley and Winton Newman.

Trade Announcements

Walsall Conduits, Ltd., has removed its London office to North End Road, West Kensington, W.14 (telephone: Fulham 6131).

The Johnson Metal Co., Ltd., has moved to Clegg's Court, 45, Chapel Street, Salford, 3, Manchester.

For Sale

The Northampton Electric Light & Power Co., Ltd., has for sale single conductor, paper-insulated, plain lead-sheathed cable.

Dorchester Corporation Electricity Department has for sale d.c. meters.

(See our classified advertisements.)

A Cooking Demonstration at Coventry

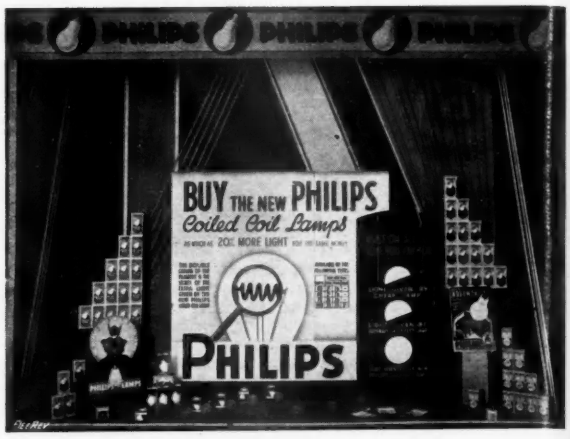
A cooking demonstration was given recently by Mrs. Pocklington, chief demonstrator of the Hotpoint Electric Appliance Co., Ltd., at the works canteen of the British Thomson-

"Hotpoint" cookers at a Coventry demonstration

Houston Co., Ltd., Coventry. Mrs. Pocklington kept up an even flow of explanatory remarks to the large audience, and the Hotpoint Company states that many of those present felt that she had forgotten the cooking, until the meal was taken from the oven perfectly cooked. The local Press, commenting upon the demonstration, stated that "Cooking without concern" might well have been its title, and the company suggests the adoption of this as a slogan.

Lamp Window Displays

With the introduction of Philips coiled-coil lamps in new wattages (60, 75 and 100-W opal and pearl and 100-W clear) an intensive window display campaign is to be launched by Philips Lamps, Ltd., and two displays are now available. The pieces are particularly striking insofar as they tell a definite story. In the one which we illustrate the actual filament is enlarged and is the centre focus, the pieces and cartons being distributed in a way that binds as a whole. In the other display the centre piece is a large illustration of the coiled coil together with a description. From the window sticker is sus-



A Philips coiled-coil lamp display

pended an actual lamp from which a ribbon directs the eye to the main piece. The company has prepared new price lists and window streamers for this scheme, supplies of which are also available.

Calendars, Diaries, Etc.

This year's calendar of Messrs. Christy Bros. & Co., Ltd., bears a beautifully coloured print on silk of an attractive girl.

Strictly business is the keynote of the calendar with large daily slips sent us by Messrs. Lindsay & Williams, Ltd.

Messrs. Francis Polden & Co.'s calendar is in the same form as in previous years—monthly sheets with a date-marking device. The company's pocket diary is again a handsome production with a red fold-over case and pencil.

A neat and useful propelling pencil has been received from the Automatic Electric Co., Ltd.

The picture chosen for the calendar of the Sloan Electrical Co., Ltd., is entitled "The Mighty Works that make us Men," and expresses the transcendent power of man over matter.

Messrs. Mavor & Coulson, Ltd., have sent us a neat little desk calendar illustrating one of their coal cutters.

The desk calendar of the Power Machinery Trading Co. has two months on each sheet with pictures of beauty spots in various parts of the country.

"More than he Bargained for" is the title of a picture on the calendar of Messrs. Norvall Bros., Ltd., which illustrates a meeting between a Canadian angler and a black bear.

A lady named "Clarice" forms a charming study for the calendar of the Concordia Electric Safety Lamp Co., Ltd.

A rural scene entitled "All the World Waiting for the Sunrise," has been chosen by the Hart Accumulator Co., Ltd., for its calendar which has large monthly slips. The company has also sent us one of its useful desk blotting pads, which, as in previous years, has a neat red binding.

The diary of the Stanton Ironworks Co., Ltd., is neatly bound in blue leather and contains a great deal of technical data relating to the company's products.

The calendar of the West Gloucestershire Power Co., Ltd., is again mounted on a neat blue board for use on the desk or for hanging on the wall, and each daily slip has a quotation from Shakespeare.

The desk calendar of Messrs. B. S. & W. Whiteley, Ltd., has daily tear-off slips with quotations from the works of popular writers.

Illustrations of the company's products appear on the calendar of Dexine, Ltd., which has large monthly sheets.

Daily slips with bold red figures form the calendar received from Messrs. Muller & Co. (England), Ltd., which also illustrates some of the company's products.

Pope's Electric Lamp Co., Ltd., advertises its "Elasta" electric lamps upon a calendar which has large monthly sheets.

The Harbour, Harfleur, beautifully coloured, makes a charming picture for the calendar received from Messrs. Ernest F. Moy, Ltd.

A picture of a pretty maiden adorns the calendar of the Supra Electrical Co., Ltd., which has daily slips with red figures.

We have received from the Hackbridge Electric Construction Co., Ltd., in association with the Hewittic Electric Co., Ltd., a handsome desk blotter bound in dark brown leatherette. This includes a weekly calendar pad, a diary, note pad, and a telephone directory.

Messrs. Wm. Sanders & Co. have sent us an interesting novelty which they are distributing amongst various members of the trade. This is a new indoor cricket game called "Owzthat."

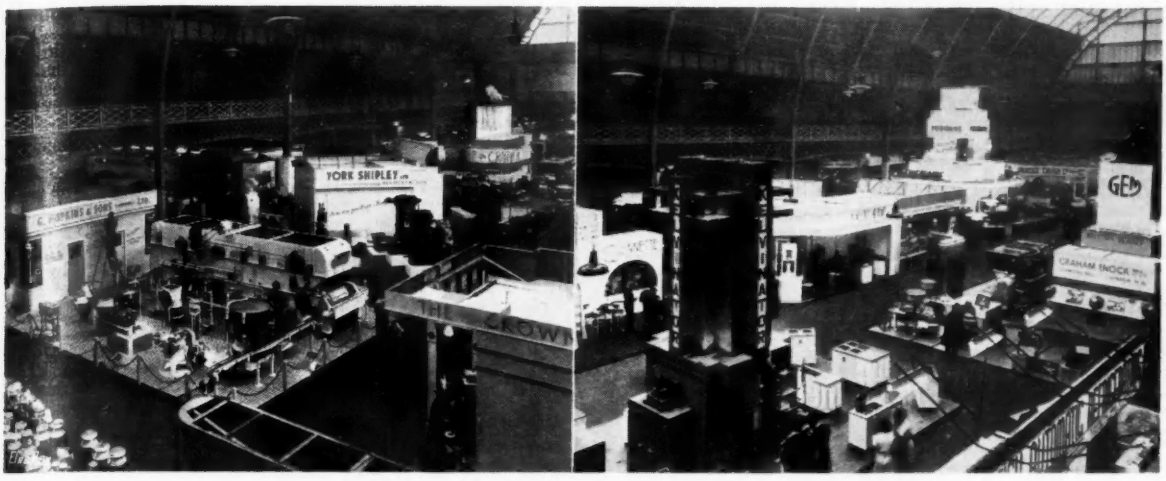
A neat little diary bound in brown leatherette has been received from the Arora Co. The company has also sent us a copy of its latest list of electric fires, in which special attention is drawn to its new "Projector" pattern.

The calendar of the Revo Electric Co., Ltd., has large daily slips with bold figures in red, and illustrates the company's works at Tipton, Staffs.

The diary received from Mr. Geo. Barnard is bound in dark brown leather. We have also received a refill for the desk calendar sent us last year.

The Dairy and Ice Cream Exhibition

There are said to be 60,000 ice-cream retailers in Great Britain of whom 40,000 are manufacturers. The fifth National Dairy and Ice Cream Exhibition held at Olympia opened on Tuesday and will be closed this (Friday) evening. Electric refrigerating cabinets are naturally prominent and the following firms are displaying their latest products: British Automatic Refrigerators; Century Refrigeration; Condrup; Electrolux; Frigidaire; Guiterman & Co.; J. & E. Hall; International Refrigerator Co.; Kelvinator; Lightfoot Refrigeration Co.; Liverpool Refrigeration Co.; Marco Refrigerators; Pulsometer Engineering Co.; and L. Sterne & Co. Electric bottle-washing machines are being exhibited by British Miller Hydro Co.; Cock & Sons; Dawson Bros.; and the Dairy Outfit Co. Electric contact regulators are shown by Short & Mason, and ultra-violet-ray milk irradiation equipment by the Creamery Package Mfg. Co., while Imperial Chemical Industries also is represented by several products. One of the most interesting exhibits are the noiseless electrically propelled milk floats of Partridge, Wilson & Co.



Two general views of the Dairy and Ice Cream Exhibition which is being held at Olympia this week

The calendar of the Davenport Engineering Co., Ltd., which has daily slips, illustrates the company's water coolers.

Illustrations of the company's products appear on the calendar of Crofts (Engineers), Ltd., which has monthly sheets.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances.

CHEMICALS, ETC.	Price. January 2nd.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£40	—
a Ammonia, Muriate (large crystal) ... ,,	£38	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£19 15s.	—
a Potash, Chlorate ... ... per lb.	3¾d. to 4¼d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac T.N. ... ... per cwt.	£4 18s.	—
a Sulphur Commercial... ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda Chlorate ... ... per lb.	3½d. to 3¾d.	—
a ,, Crystals... ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. net.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil... ... ... ,,	1/2 to 2/9	—
p Babbits Metal and Anti friction Metals—		
Grade I ... ... per ton net	£206	—
Grade II ... ... ,,	£141	—
Grade III ... ... ,,	£69	—
c Brass (rolled metal 2" to 12" basis)... per lb.	6¾d.	—
c ,, Tubes (solid drawn) ... ... ,,	8¾d. to 9d.	—
c ,, Wire, basis ... ... ,,	7d.	—
c Copper Tubes (solid drawn)... ... ,,	9¼d.	—
g ,, Bars (best selected)... ... per ton	£58	—
g ,, Sheet ... ... ,,		
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars ... ... ,,	£30 10s.	—
g ,, ,, Sheets ... ... ,,	£32	—
d ,, ,, Wire Rods ... ,,	£35 10s.	—
d ,, ,, H.C. Wire ... per lb.	6¾d.	—
f Ebonite Rod ... ... ,,	1/6 to 2/– plus	—
,, Sheet ... ... ,,	1/3 to 1/6 } 10%	—
m German Silver Wire ... ... ,,	2/5	—
h Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para fine ... ... ,,	5d.	—
i Iron, Pig (Cleveland No. 3) ... per ton	62/6	—
i ,, Wire galv. No. 1, P.O. qual.... ,,	£20	—
g Lead, English Pig ... ... ,,	£12 10s.	—
g Mercury ... ... per bot.	£11/12/6 to £11/15	2s. 6d. inc.
c Mica (in original cases) small ... per lb.	6d. to 3/6	—
c ,, ,, medium ... ,,	4/- to 8/-	—
c ,, ,, large ... ,,	8/6 to 17/6 & up	—
p Phosphor Bronze, plain castings ... ,,	1/1	—
p ,, ,, drawn bars & rods ,,	10¾d.	—
p ,, ,, rolled strip & Sheet ,,	10¾d.	—
p ,, ,, wire ... ... ,,	11¾d.	—
o Platinum ... ... per oz.	£7 15s.	—
d Silicium Bronze Wire ... ... per lb.	7 ½d.	—
r Steel, magnet, in bars ... ... ,,	7¼d.	—
g Tin, Block (English) ... ... per ton	£228 15s. to £230 15s.	5s. inc.
n ,, Wire, Nos. 1 to 18 ... ... per lb.	3/8	—

Quotations supplied by :—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
m P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. F. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead and rubber, up to the time of going to press, are given in our "Business Notes" under the same heading.

New Catalogues and Lists

London Aluminium Co., Ltd., Westwood Road, Witton, Birmingham.—A leaflet on new "Diamond" kettles.

Mather & Platt, Ltd., Park Works, Manchester, 10.—A booklet on "Mulsifyre" system of extinguishing oil fires.

Ray Engineering Co., Ltd., Waterdale Works, Southend, Bristol.—Leaflets on battery charging and generator switchboards.

Igranic Electric Co., Ltd., 147, Queen Victoria Street, E.C.4.—Leaflets on "across-the-line" starters, star-delta starters, and reversing starters.

Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4.—A pamphlet on mechanical cable laying.

Company Liquidations

A. S. Plater & Co., Ltd., electrical engineers, 19, High Street, Wood Green.—The accounts lodged under the compulsory liquidation of this company show liabilities of £1,216, assets of £460, and an issued capital of 1,500 ordinary shares of £1 each. Mr. J. Barwick Thompson, Official Receiver and Liquidator, réports that the company was formed in 1932 to carry on business as electrical engineers and general electrical installation contractors. Alfred Stanley Plater states that he had carried on business for a number of years and, having incurred a serious financial loss as the result of a certain contract, he decided in the latter part of 1932 to convert the business into a limited company to obtain the protection against personal liability afforded by the Companies Act. The company took over the assets of Plater's business for £1,450, which was paid by cheque, and in return Plater handed to the company cheques for £1,499 in payment for shares; the balance of £49 remained as working capital. The company appears to have done very little business since June last. The failure is attributed to general depression in the electrical trade and inability to recover a book debt of £460, which constitutes the sole asset of the company. In the opinion of the Official Receiver, the failure of the company is directly attributable to mismanagement.

Kelvin Accumulator Co., Ltd.—Meetings January 31st at the offices of Messrs. Poppleton & Appleby, 35, Windsor Place, Cardiff, to receive an account of the winding-up by the liquidator, Mr. L. Stewart Findlay.

Northern Electrical Wholesalers, Ltd.—Meeting of members January 26th at Exchange Buildings, Whitehead Street, South Shields, to receive an account of the winding-up by the liquidator, Mr. J. W. E. Rutherford.

Bankruptcy Proceedings

C. F. du Bock (formerly trading as the "Bright Electrical Co."), 55, Ridley Road, Forest Gate, E.7, electric lamp distributor.—Receiving order made December 21st on a creditor's petition. First meeting January 7th and public examination February 27th, both at Bankruptcy Buildings, Carey Street, W.C.2.

H. Yeo, 3, Hillhead, Stratton, Cornwall, radio engineer.—Receiving order made December 20th on debtor's own petition.

Electricity Supply

Lighting, Domestic, Power

Aberdeen.—ELECTRICAL DEVELOPMENT.—An upward tendency in electricity sales (in October the kWh generated was 271,750 more than in the corresponding month of 1933) has encouraged the Electricity Department to proceed with extensions of mains in various parts of the town and district at a cost of £2,976. Charges to ordinary consumers have recently been reduced, and it is suggested that concessions should now be made to certain large power users who take supplies under agreement for a term of years.

Barking.—COOKER REPAIR.—The erection and equipment of a cooker refitting department at an estimated cost of £6,500 is recommended by the Electricity Department.

Barnard Castle.—SUB-STATION.—The Urban District Council has approved plans by the North-Eastern Electric Supply Co., Ltd., for the erection of a sub-station in Birch Road.

Bedfordshire.—SCHOOL LIGHTING.—The County Education Committee is to have electric lighting installed at Stevington, Oakley, Houghton Conquest, Kempton Rural Junior, Pavenham, Westoning, and Dunstable Chew's schools.

Biggleswade.—SUPPLY TO COUNCIL HOUSES.—The First Garden City Electricity Department is to supply electricity to houses at the Dells, Biggleswade, if the Biggleswade Urban District Council wires the houses. It is proposed that the tenants shall pay the Council 6d. per week for three years towards the cost of wiring.

LIGHTING OF CHAPEL FIELDS.—The Urban District Council has instructed its surveyor to investigate and report on the lighting of Chapel Fields.

Brighton.—EXTENSION ORDER.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order authorising the Corporation to acquire and use certain lands for the extension of its generating station at Southwick. Objections to the Order must be made to the Minister by January 20th.

Cheadle and Gatley.—STATION LIGHTING.—The L.M.S. Railway Co. has notified the Cheadle and Gatley Council that it cannot see its way to adopt the suggestion that the Cheadle Hulme and Gatley stations shall be lighted by electricity. The Council offered the railway company a rate for the supply of electricity which was little more than the cost price.

Chester.—ILLUMINATIONS.—A special committee has been appointed by the City Council to consider a scheme prepared by the electrical engineer for illumination of the principal features of the city during spring and autumn.

Chichester.—SPECIAL NIGHT CHARGE.—The City Council is to supply electricity to a large industrial consumer from 9 p.m. till 7 a.m. at ½d. per kWh.

RING MAIN.—The Electricity Department is constructing a ring main from Lavant to Shopwyke.

CORPORATION BILL.—A public meeting has approved the promotion by the City Council of a Bill in Parliament to grant the Corporation, *inter alia*, additional powers with regard to its electricity undertaking.

Chipping Norton.—COUNCIL HOUSE SUPPLIES.—The Town Council is negotiating with the local electricity supply company with regard to providing a supply to the proposed new Council houses.

Coldstream (Berwickshire).—TRANSMISSION SCHEME.—The Town Council has approved plans submitted by the North-Eastern Electric Supply Co., Ltd., for overhead and underground cables from Cornhill to Coldstream.

Croydon.—REDUCED WINTER CHARGE.—The winter "unit" charge under the all-in system has been reduced by the Town Council from 0.675d. to 0.625d. The authority has also reduced the standing charge under the all-in business rate from £12 4s. to £11.

Cuckfield.—PROTEST AT DELAY.—The Rural District Council is protesting to the Electricity Commissioners with regard to the delay of the Weald Electricity Co. in supplying electricity to West Hoathley.

Cumnock.—ALL-ELECTRIC HOUSES.—The Town Council is considering the merits of the all-electric house compared with the type of house electrically lighted, with a coal fire and a gas cooker, in connection with its housing estate. Having interviewed Mr. William Bexon, of the Ayrshire Electricity Board, and a representative of the local gas company, the Council decided to consider alternative tenders.

Dorchester.—CHANGE-OVER.—The Corporation has announced its intention to complete the change-over of the supply to 400 V, 3-phase, 50 cycles and 230 V, single-phase, 50 cycles.

Dorrington.—PREPARATIONS FOR SUPPLY.—Overhead-line work has been commenced in preparation for supplying electricity to the village.

Earby.—EXTENSIONS.—The Urban District Council proposes to lay a cable to supply houses in Green End Road.

Edinburgh.—STREET LIGHTING.—The Streets and Buildings Committee reports that during the last financial year £1,333 was expended on the improvement of street lighting, and in the current year's estimates provision has been made for the expenditure of £1,500 for this purpose. The experimental installation in Queensferry Road of sixteen high-pressure 400-W electric-discharge lamps having given satisfaction, the Committee has agreed to purchase these lamps, and favours an extension eastwards of lighting by 250-W lamps of this type. The number of electric stairlights at present is 7,555, and the policy of converting gas to electric stairlights district by district is under consideration.

Elland.—CHEAPER ELECTRICITY.—The Urban District Council has reduced electricity charges as from January 1st. The rateable-value basis for house and house-and-shop lighting is 17½ per cent. per annum, up to a maximum of £7 10s. (instead of 22½ per cent.) and the rateable-value charge for lock-up shops is reduced from 27½ to 22½ per cent. The maximum rate for power is now 3d. per kWh (previously 3½d.); and, in the case of small consumers, the meter rent for lighting is abolished where the two-part tariff applies.

Emsworth.—HOSPITAL LIGHTING.—Improvements in the electric lighting arrangements are to be carried out at the Victoria Cottage Hospital.

Essex.—ELECTRICITY PROPOSED FOR INSTITUTION.—The Public Assistance Committee is to have a report prepared by the county architect with regard to the installation of electric lighting in the Institution at Chelmsford.

Fleetwood. — PLANT MODERNISATION: — A comprehensive scheme to modernise the equipment at the port of Fleetwood, at a cost of £85,000, is planned by L.M.S. Railway Co. The work, which includes the substitution of electric for hydraulic power, will be put into operation almost immediately, and it is intended to complete it within twelve months.

Gateshead.—CABLES.—The North-Eastern Electric Supply Co., Ltd., is to lay cables in Cleasby Gardens, Gateshead.

Glasgow.—MANY MORE CONSUMERS.—A remarkable increase in the use of electricity is reported. The revenue for the six months ended November 30th shows an improvement of £20,122, whereas a decrease was anticipated owing to reductions in charges. The consumption increased by almost 21,000,000 kWh, of which 15,000,000 kWh was used for industrial power. The number of consumers increased by 6,878.

SUB-STATION.—The Electricity Department proposes to erect a sub-station at Frankfield Street.

Grimsby.—SUPPLY EXTENSIONS.—The Electricity Committee is seeking sanction to borrow £10,430 to provide a supply to the R.A.F. aerodrome, North Cotes, and to the villages of Ludborough, Fulstow, Marshchapel and North Cotes.

Guildford.—REWIRING THE GUILDHALL.—The Town Council has accepted a quotation of the borough electrical engineer for rewiring the Guildhall, including facilities for floodlighting the front.

Halifax.—ELECTRICITY AND FARMHOUSES.—Where electricity is required for farmhouses within a reasonable distance from the mains for domestic purposes (according to a recommendation of the Electricity Committee) the charge is to be 15 per cent. on the rateable value of the house, with a minimum charge of 30s. a year, plus ½d. per kW. Where electricity is required for farm purposes it is proposed that the charge shall be 25 per cent. of the rateable value, with a minimum charge of £2, plus ½d. per kWh.

Hereford.—SCHOOL INSTALLATIONS.—The Education Committee has authorised the installation of electric lighting at two schools.

Herts.—PARLIAMENTARY BILL.—The County Council has approved a Parliamentary Bill providing, *inter alia*, for powers regarding electricity undertakings, floodlighting of country roads, &c.

Isle of Wight.—INQUIRY.—A Ministry of Transport inquiry was held recently to consider an application from the Isle of Wight Electric Light & Power Co. to erect overhead lines to supply thirty houses at Bonchurch. The application was opposed by the local District Council, which contended that amenities would be affected.

Kettering.—NEW SUPPLIES.—The Electricity Department is to provide supplies to Isham (£1,191); Marston Trussell (£1,115); Ashley, Weston-by-Welland and Sutton Bassett (£3,168).

Kilmarnock.—COMPOSITION OF AYRSHIRE ELECTRICITY BOARD.—The Town Council has approved the recommendation of a conference held at Ayr that the three constituent authorities on the Ayrshire Electricity Board should agree to an alteration in the number of members on the Board from twelve to thirteen to be apportioned among the authorities as follows: Kilmarnock Town Council, four; Ayr Town Council, three; County Council, six. The conference also recommended that the constituent authorities should join in an application to the Secretary of State for Scotland to give effect to these proposals. If this agreement is confirmed by the three bodies concerned the part of the County Council's Provisional Order seeking to have the undertaking of the Ayrshire Electricity Board transferred to the County Council will be deleted.

Kincardineshire.—ELECTRICITY IN SCHOOLS.—An offer by the Grampian Electricity Supply Co. to supply electricity to schools at a rate of 2s. 9d. per quarter per 100 W of lighting installed, plus ¾d. per kWh consumed, has been remitted by the County Council to the Education Committee. In addition to lighting, it is suggested that electricity may be used for heating.

Lanark.—SUPPLY SCHEME.—The Clyde Valley Electrical Power Company is to commence a scheme to lay new overhead and underground cables in fifteen districts in Lanarkshire. Work has been started in six different parts of the county. The seventh area in which new cables well be laid is Strathaven, Bothwell, New Stevenston, Mount Vernon, Shotts, and Glassford.

Lancaster.—EXTENSIONS INAUGURATED.—Supplies of electricity from the Electricity Department were switched on for the first time on December 21st to the villages of Caton, Brookhouse, Hornby, and Tunstall.

Leatherhead.—OVERHEAD LINES.—The Urban District Council has consented to the use of overhead lines from Long Copse, Fetcham, to the Park, Great Bookham, by the London and Home Counties J.E.A., but has notified the Minister of Transport of its objection to overhead lines in general.

Leicester.—NEW BOILER.—The Electricity Department proposes to purchase a new boiler (£89,000).

Lichfield.—HOUSE WIRING.—The Electricity Department is to install electric light in a number of houses at Shenstone and Stonnall under the assisted-wiring scheme.

Llandudno.—CHANGE-OVER.—Expenditure incurred in connection with the change-over from d.c. to a.c. in the Craigydon district of Llandudno amounted to £8,054 instead of the £6,954 estimated. The excess is stated to be mainly attributable to additional lengths of l.v. cable laid and to the cost of adapting electrical apparatus to suit the altered system.

London.—ISLINGTON.—The Electricity Committee considers that the rate of 4d. per kWh for energy supplied through prepayment meters should now be reduced to 3½d. per kWh where the total installation is less than the equivalent of 150 W and is not one of the Council's rental-wiring installations.

STEPNEY.—We regret that the note published last week under Stepney referred to recommendations by the *St. Pancras* Electricity Committee. It is repeated under the correct heading this week.

ST. PANCRAS.—The Electricity and Public Lighting Committee recommends that an optional rate of charge for large consumers shall be introduced. It will be £5 per kW of maximum demand to cover lighting, heating and power (subject to a minimum payment of £800 per annum), with a running charge of ⅝d. per kWh for electricity consumed. An oil-driven house set costing £848 is recommended for the King's Road Station, and mains are to be extended at a cost of £430.

Lowestoft.—LOANS APPLIED FOR.—The Town Council has applied for loans of £20,000 for mains and services, £10,000 for domestic appliances, £2,500 for sub-station equipment, £2,500 for house-wiring installations, and £1,600 for h.p. feeder cables from the works to the Queen's Road sub-station, to meet the increasing demand for electricity along the Marine Parade.

Millom.—OVERHEAD LINES.—The Rural District Council has decided to withhold its consent to the use of overhead cables by the South Cumberland Electricity Supply Co., Ltd., for an extension from Duddon Bridge to Hill-in-Millom, and requests that all cables in villages should be underground. The company has intimated that a scheme is being prepared for extending the e.h.p. line to Kirksanton and Silecroft.

Morayshire.—PLEBISCITE AT BURGHEAD.—A plebiscite is to be taken at Burghead on the question of introducing a supply of electricity. The Council has informed the Grampian Supply Co. that if power is made available it will favourably consider lighting the streets with electricity.

Newcastleton.—VOTE TO ASCERTAIN DEMAND.—The Roxburgh County Council has agreed to a postal ballot in Newcastleton to ascertain if there is enough demand for electricity to justify the outlay in providing a supply by the Dumfriesshire County Council.

North-East Coast.—LOWER TARIFF.—The North-Eastern Electric Supply Co., Ltd., has announced a new tariff of electricity charges for the small-power users which will cost the company £25,000 per annum. The charges are: First 3,000 kWh per quarter, 1½d. per kWh; all over 3,000 kWh per quarter, 1¼d. A discount of 5 per cent. will be allowed for prompt payment. No meter rentals will be charged.

Norwich.—ELECTRIC HEATING.—A special committee reports that it has considered the question of the heating arrangements at the new municipal buildings, and favours a system of electric heating, subject to costs and other factors being satisfactory. The electrical engineer has been asked to report on the matter.

Oban.—SUPPLY TO ESTATE.—An application is to be made for a loan of £3,612 for providing electricity to the new housing estate at Dalintart.

Penge.—ELECTRICITY FOR COUNCIL HOUSES.—The Urban District Council has consented to the tenants of forty-nine council houses having electric lighting installed on payment of an additional 3d. per week rent.

Preston.—ENCOURAGING SOIL HEATING.—The Electricity Committee proposes to erect a greenhouse on the roof of the Lune Street offices to demonstrate soil heating.

LOANS.—The Electricity Committee has decided to apply to the Electricity Commissioners for sanction to borrow the following amounts for the general purposes of the electricity undertaking for three years from April 1st, 1935: Mains and services, £160,000; transformers and switchgear, £35,000; domestic apparatus, £75,000; meters, £25,000.

Rugby.—OVERHEAD LINES.—The Rural District Council has consented to the use of overhead lines on the London Road, Stretton-on-Dunsmore, and also along Shielton Road, Bulkington, by the Leicestershire & Warwickshire Electric Power Co., Ltd.

Settle.—ELECTRICITY CHARGES.—A committee representing Settle and Bentham is to meet representatives of the Settle & District Electricity Co. in the hope of coming to an agreement with regard to the new electricity tariff.

Sheffield.—NEW PLANT.—The Electricity Commissioners have sanctioned the borrowing of £25,126 for electrical plant, &c.

EXTENSIONS.—The Electricity Committee has approved extensions to mains involving an expenditure of £8,086.

Shipley.—COOKERS.—Consumers paying through prepayment meters are to be allowed to choose any size of cooker, according to a recommendation of the Electricity Committee. The payment to be made is 7s. 6d., plus the difference between the cost of the cooker supplied and that of a "201" cooker without extras.

Shirebrook.—SCHOOL LIGHTING.—Arrangements are being made by the Derbyshire Education Committee for the installation of electric lighting at the secondary school.

Southend-on-Sea.—NEW APPARATUS.—The Town Council has applied for a loan of £50,000 for apparatus to be supplied under the hiring scheme. Agreement has been reached with the County of London Electric Supply Co., Ltd., with reference to the supply to the area added to the borough, in contemplation of the Corporation furnishing a supply to Great Wakering. The company, which has already expended £10,536 in the area, is to be paid £14,500.

Stirling.—FLOODLIGHTING.—The Old Burgh Buildings are being floodlighted from December 22nd until January 5th.

REDUCED CHARGES.—The charges for house lighting have been reduced by ½d. per kWh.

Strood.—FRINGE ORDER.—The Rural District Council has given its consent to an application by Gravesend Town Council for a Fringe Order to supply premises at Cobham.

Tendring.—OVERHEAD LINES.—The Rural District Council has decided to raise no objection to overhead lines being erected at Frating Green and in Brightlingsea Road, Thorington, by Colchester Electricity Department.

Thirsk.—SUPPLY EXTENSION.—The Rural District Council has received a notification from the North-Eastern Electric Supply Co., Ltd., that it intends to supply electricity to Norton-le-Clay.

Thurso.—SUPPLY INAUGURATED.—The supply of electricity by Public Utilities, Ltd., has been inaugurated.

Tonbridge.—OVERHEAD LINES.—The Rural District Council has consented to the Weald Electricity Supply Co., Ltd., erecting overhead lines at Lowlands and Hatmill, Brenchley.

Wakefield.—REDUCED CHARGES.—Reductions in electricity charges were announced by the City Council on Monday, to date as from the meter reading nearest to January 1st. The lighting charge up to 250 kWh per quarter is now 4½d. per kWh instead of 5d.; up to 1,000 3¾d (4d.); and over that figure 2d. (3d.). There are also reductions of between 10 and 25 per cent.. in the tariffs for heating, water heating, all-electric houses (now ¾d. per kWh), prepayment meters (lighting), ordinary small power users, churches, cinemas and the domestic rateable-value scale.

Wallasey.—CENTRAL HEATING.—The Electricity Committee has decided to offer electrical energy for the central heating of buildings at a special tariff of 0.4d. per kWh in cases where the heating system is time controlled so that the load occurs only at off-peak periods.

Weymouth.—ELECTRICITY AT FRIAR WADDON.—The Town Council has received sanction from the Ministry of Transport to place overhead lines in the Friar Waddon area.

Whitburn (West Lothian).—TERMS ACCEPTED.—The Town Council, after a vote on electricity *v.* gas in new housing schemes, has agreed to accept the Scottish Midlands Electricity Supply Co.'s terms.

Wilcot.—SUPPLY PROMISED.—The Minister of Transport has written to the Parish Council stating that a scheme for supplying the village has been prepared and is included in the Wessex Electricity Co.'s 1935 programme. Work will probably be commenced in the spring.

Wrestlingworth.—REQUEST FOR SUPPLY.—The village has been urging the local supply company for nearly two years to provide electricity, and the clerk to the Council has now been instructed to write again, asking the company to give the matter its early attention.

Traction

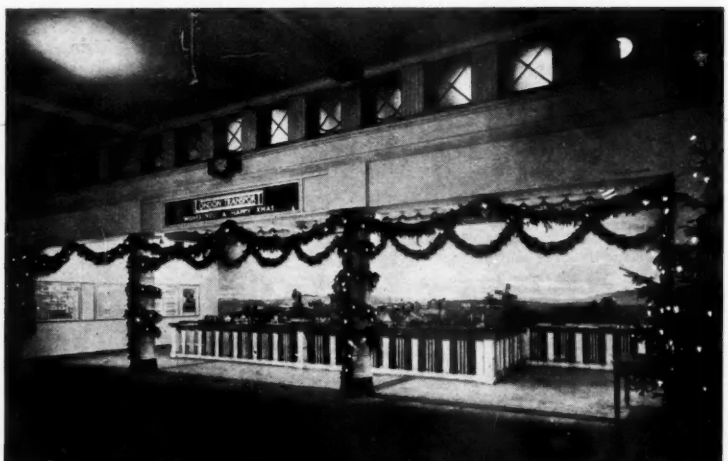
Australia.—SYDNEY TRAMWAYS.—Replying to a deputation from the Randwick Council which asked for an extension of the Sydney tramways, Mr. S. Maddocks, Commissioner for Transport, New South Wales, stated that if the extension were granted it would mean considerable expenditure without any extra revenue. The Department, he said, had already to find interest, sinking fund and exchange on a public indebtedness of nearly £12,000,000, in addition to which £680,179 had been charged against the Department for accumulated deficits of these payments during the past three years. The difficulty of getting the metropolitan services in a solvent condition had been increased by cheaper fares, both on the railways and the tramways.

Bolton.—TRANSPORT SERVICE.—The Transport Committee and Horwich Council have discussed the question of substituting buses for trams between the two towns, and the latter authority has agreed to the substitution provided the upkeep of roads and stops is arranged to its satisfaction.

Bournemouth.—TROLLEY-BUSES.—The Transport Committee has authorised the provision by the British Thomson-Houston Co., Ltd., of additional electrical equipment required to comply with the instructions of the Ministry of Transport for limiting the speed of trolley-buses when travelling downhill and to prevent them running backwards.

Ipswich.—COUNTY COUNCIL OPPOSITION.—The East Suffolk County Council is opposing the proposal of the Town Council to extend its trolley-bus system along Humber Doncy Lane.

London.—STREET TRAFFIC SIGNALS.—During 1934 136 installations of three-colour street traffic signals were brought into operation in the London traffic area, involving the erection of 737 standards. The total number of such installations in the London traffic area is now 374, of which 246 are in the Metropolitan boroughs.



The appearance of the underground railway station at Charing Cross at Christmas attracted favourable comment, "Osram" decorative lamps being used to provide a colourful setting

L.M.S. Railway.—DIESEL-ELECTRIC LOCOMOTIVES.—A £9,300,000 plan for the L.M.S. Railway during the year includes the provision of twenty Diesel-electric shunting locomotives.

Preston.—NEW LOCOMOTIVE.—The Ribble Committee has decided to purchase a new Diesel-electric shunting locomotive for the dock at a cost of £4,000.

Reading.—COST OF TROLLEY-BUSES.—It was stated at a Town Council meeting that the cost of substituting trolley-buses for the trams would be: Trolley-buses, £60,000; electrical equipment and constructional work, £27,730; erection or adaptation of buildings, £13,500; removal of tramway track and reconstruction of roads, £64,500.

South Africa.—JOHANNESBURG TRANSPORT REORGANISATION.—The Johannesburg City Council has approved in principle an extensive scheme of reorganisation of the municipal transport system. The recommendations closely follow the lines of the recent report of the Transport Inquiry Commission, under the chairmanship of Mr. C. J. Spencer, of London. They include the doubling of many sections of the tramway track and the replacement of tramcars by omnibuses on several important routes.

Southern Railway.—THE SEVENOAKS EXTENSION.—The new electrified extension to Sevenoaks described in our issue of December 21st will be opened on January 6th. The number of trains per hour between Charing Cross and Sevenoaks is to be increased from two to six.

York.—PROPOSED TRAMWAY ABANDONMENT.—The Corporation and the West Yorkshire Road Car Co., as joint operators of the tramway undertaking, have applied to the Yorkshire Traffic Commissioners for permission to substitute buses for trams on the York-Dringhouses route.

Communications

Canada.—BLATTNERPHONE BROADCASTS.—The *Times* Ottawa correspondent reports that the Canadian Radio Commission has completed plans for the erection of a small station with Blattnerphone equipment, provided by the B.B.C., at Britannia, nine miles from the centre of the city. The main purpose will be to give better facilities for hearing European and particularly British broadcasts delivered in the evening (afternoon in Canada).

Germany.—"CONFERENCE CALLS."—The German Post Office has introduced "conference calls" into its telephone service with foreign countries. With these calls up to five German subscribers, by means of a special device, may be simultaneously linked with an international connection; there is a fixed charge of two marks for each subscriber, in addition to the Berlin central exchange fee for a foreign call, the whole amount being payable by the subscriber making the call.—*The Times.*

Great Britain.—£6,000,000 TELEPHONE SCHEMES.—The Postmaster-General has announced that during 1935 there will be further activity in connection with an extensive programme of underground telephone cable-laying, the cost being about £6,000,000. New cables will be laid between London and Liverpool, Newcastle and Carlisle, and Gloucester and Oxford, and 200 automatic exchanges will be opened.

BROADCASTING EVENTS IN 1934.—In a review of outstanding events in British broadcasting during the year 1934 the B.B.C. states that the transmission hours for the year (excluding the Empire station) amounted to 63,109 hours, the average breakdown percentage being 0.022. The Empire station transmitted for 10,897 hours. The new National programme long-wave transmitter at Droitwich, which replaced Daventry (5XX), was completed in the early summer, and the erection of the new medium-wave Midland Regional transmitter is now complete; it will take over the Midland Regional service from Daventry early in 1935, leaving the Daventry site free for further experiments and expansion in connection with the Empire service. During the year the construction of the new regional station in Northern Ireland was begun; it will be put into operation towards the end of 1935. A site was chosen for the new North Scottish Regional station at Burghead, near Elgin, and tests are in progress on proposed sites for the North-East Regional station which will replace the existing low-power transmitter serving Newcastle. Tests were carried out in North Wales and South Devon to ascertain what service is likely to be given by low-power transmitters in those areas. The progressive renovation and extension of studio premises has proceeded in various centres, notably at Bristol, Manchester, Newcastle, Glasgow, Bangor (North Wales), and in Maida Vale (London), where the new studio is 110 ft. long and 72 ft. wide, being the largest in the country. Wavelength allocations on the Lucerne plan, which came into operation on January 15th, 1934, resulted in a marked decrease in interference between stations in the medium band, but some countries with transmitters operating in the long band have not conformed to the plan. The Research Department has been rehoused in more suitable premises in South London. Regular television programmes of the low-definition type were transmitted by the Baird process on two evenings a week during most of the year. Several notable broadcasts were arranged in co-operation with Empire broadcasting organisations in the Dominions and Colonies. The availability of the Empire service has stimulated the establishment of wireless exchanges and rebroadcasting facilities in, for example, the West African Colonies and in Ceylon; and there has been evidence of future development in this direction in other Colonies.

RADIO-TELEPHONY.—The experiments in radio-telephony between Great Britain and Northern Ireland have proved successful, and the new service was in operation at Christmas.

Greece.—MARCONI CONCESSION.—An *Exchange Telegraph* message from Athens states that the Wireless Council has initialled a draft convention to be entered into between the Greek Government and Marconi's Wireless Telegraph Co., granting to the company the exclusive right for the installation and exploitation of broadcasting stations throughout Greece for twenty-five years. The control will extend to the central broadcasting station in Athens. The majority of the shares of a company to be formed for this purpose will be held by Greek subjects. The convention will be submitted for the approval of the Council of Ministers.

Isle of Wight.—RADIO BEACON.—A radio beacon is to be established at Nab lighthouse, on the east side of the Isle of Wight, to assist in navigating large liners to port.

Merthyr Tydfil.—TELEPHONES IN SCHOOLS.—The Education Authority is to consider the installation of telephones in secondary schools.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Army Contracts.—Manufacturers who are not on the War Office list of tenderers and wish to be invited to tender for general stores should apply to the Director of Army Contracts, Caxton House (West), Tothill Street, S.W.1. (See this issue.)

Australia.—SYDNEY.—N.S.W. Department of Road Transport. January 28th. Traffic control equipment for nineteen street intersections. (A.Y. 12796.)*

BRISBANE.—April 2nd. City Electric Light Co. 11,000-V and 415-V metal clad switchgear. (A.Y. 12841.)*

MELBOURNE.—Posts and Telegraphs Department. January 29th. Ringing and tone equipment (vibratory type) and delayed alarm control equipment. (A.Y. 12771.)*

February 19th. Magnets and automatic telephone hand-sets and accessories. (A.Y. 12829.)* Jumper and other insulated wire. (A.Y. 12831.)*

February 5th. Outside distributing wire. (A.Y. 12830.)*

Beckenham.—January 28th. U.D.C. L.p. paper-insulated cables. (December 28th.)

Bedford.—January 10th. Beds and Northants Joint Board for the Mentally Defective. Electric installation work at Bromham Colony. (December 14th.)

Belfast.—January 18th. Electricity Department. Materials for one year commencing April 1st. (See this issue.)

Bexley.—January 26th. U.D.C. Street-lighting equipment. (December 21st.)

Birmingham.—January 15th. Corporation. Thirty lead plate batteries for electric vehicles. (December 21st.)

Cheadle & Gatley.—January 17th. Electricity Department. One 250-kVA 6.6-kV transformer switch and distribution kiosk sub-station. (See this issue.)

Chesterfield.—January 12th. One 250-kW two-bulb rectifier equipment. (December 21st.)

Cleethorpes.—January 25th. U.D.C. Electric lift and motor for electricity showrooms. Particulars from the U.D.C. engineer.

Dumfries.—January 15th. Town Council. Various works, including electric lighting at their Nithside housing scheme (ninety-six houses). Specifications and forms from R. S. Osborne, burgh surveyor; tenders to town clerk.

Dundee.—January 10th. Electricity Department. Luminous discharge tube sign over shop front at the electricity showroom. Specifications and forms from D. H. Bishop, general manager and engineer, Dudhope Crescent Road; tenders to town clerk.

Dunstable.—January 7th. Corporation. Electric lighting installation in fifty houses at Garden Road and Periwinkle Lane. Particulars from the borough engineer.

Egypt.—CAIRO.—January 21st. Ministry of Public Works. Three portable d.c. generating sets with cables, projectors, lamps, &c. (A.Y. 12822.)*

Epsom and Ewell.—January 14th. Electricity Department. L.p. cable. (See this issue.)

Exeter.—January 5th. Devon C.C. Electrically operated swing bridge over canal. Particulars from the county surveyor (deposit £5 5s.).

Farnborough.—January 19th. U.D.C. Street lighting for aproximately 4½ miles of main roads. (December 28th.)

Hastings.—January 31st. Electricity Department. Copper wire, &c., for the year ending March 31st, 1936. (December 28th.) Electrical materials for the year ending March 31st, 1936. (December 7th.)

Heston and Isleworth.—January 4th. Electricity Department. Enamelled slate d.c. feeder panels, complete with circuit-breakers. (December 28th.)

Hull.—January 15th. Electricity Department. Stores and haulage for twelve months from April 1st. (See this issue.)

Ilford.—January 18th. Electricity Department. 500-kVA outdoor transformer. (December 28th.)

Irish Free State.—DUBLIN.—January 31st. Electricity Supply Board. One 20,000-kW turbo-alternator and exciter, complete with condensing and auxiliary plant. (December 14th.)

Kingston-upon-Thames.—February 7th. Corporation. Street lighting equipment, with electric discharge lamps. (See this issue.)

Liverpool.—January 23rd. Corporation. Materials for the year ending March 31st, 1936. (See this issue.)

London.—CAMBERWELL.—January 14th. Borough Council. Twelve months' contracts for various items including the maintenance of electric lighting, heating and power installations, electric clocks, &c., and the supply of electric lamps. Forms of tender, &c., from borough engineer and surveyor, Town Hall.

ISLINGTON.—January 16th. Borough Council. Electrical and engineers' stores for one year commencing April 1st, 1935. (December 14th.)

POPLAR.—January 16th. Borough Council. D.c. three-wire switchboard. (December 21st.)

WANDSWORTH.—January 9th. Borough Council. Various items, including lamps. Particulars from the town clerk.

Manchester.—January 14th. Electricity Department. Two neutral earthing resistances for Stuart Street power station and two transformer oil purification equipments for High Street depôt, Charlton-on-Medlock. (See this issue.)

New Zealand.—CHRISTCHURCH.—Drainage Board. April 5th. Three electrically driven sewage pumping sets, with starters, pipes, valves, &c. (G.Y. 14505.)* Five panels of switchgear for supply to a pumping station. (A.Y. 12795.)*

WELLINGTON.—Posts and Telegraphs Department. February 12th. Biasing springs, bridging coils, keys, jacks, &c. (A.Y. 12847.)*

February 4th. Insulated and braided bronze wire. (A.Y. 12834.)*

February 13th. Power relays. (A.Y. 12780.)*

February 14th. 15,000-ft. of switchboard cables. (A.Y. 12842.)*

February 20th. Insulated, impregnated and l.c. telephone cable. (A.Y. 12828.)*

February 21st. Flameproof jumper wire. (A.Y. 12832.)*

February 21st. V.i.r. wire. (A.Y. 12843.)*

February 25th. Enamelled copper wire. (A.Y. 12804.)*

February 26th. 5,100 galvanised earth rods. (A.Y. 12836.)*

February 28th. Switchboard cables. (A.Y. 12837.)*

Public Works Department. February 19th. 50-kV outdoor switchgear, including steelwork, for Henderson sub-station. (A.Y. 12758.)*

March 5th. Seven 8,000-kVA transformers. (A.Y. 12757.)*

Porthcawl.—January 14th. U.D.C. Three sets of electrically driven centrifugal sewage pumps. Particulars from J. Taylor & Sons, engineers, Caxton House, Westminster, S.W.1.

Saltcoats (AYRSHIRE).—January 10th. Town Council. Electric lighting at new housing scheme. Schedules from H. Thomson & Sons, architect and surveyor, 60, Hamilton Street; tenders to joint town clerks.

Sheffield.—January 8th. Electricity Department. Transformers, switchgear and reactors. (December 21st.)

South Africa.—JOHANNESBURG.—January 29th. Electricity Supply Commission. Steam-raising plant, steam turbine-driven alternators, and three feed pumps and feed heaters and surge tanks. (G.Y. 14522.)*

PRETORIA.—Union Tender and Supplies Board. January 11th. 150 automatic patrol telephone hand-sets. (A.Y. 12814.)*

January 18th. Government Supplies Board. Private branch telephone exchange switchboards and material. (A.Y. 12825.)*

Stoke-on-Trent.—January 9th. Electricity Department. Battery repairs at Burslem sub-works. (December 28th.)

Uruguay.—MONTEVIDEO.—State Electricity Supply and Telephones Administration. February 4th. Porcelain insulators, fuses, &c. (A.Y. 12813.)*

March 4th. 45,000 aerial fuses and 65,000 fuse plugs. (A.Y. 12815.)*

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* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Airdrie.—Town Council. Accepted. Electric lighting at housing scheme.—G. F. Mackay & Sons.

Barking.—Electricity Committee. Recommended. Switchgear.—Harland Engineering Co., Ltd. Cables for twelve months.—Hackbridge Cable Co., Ltd.; Connollys (Blackley), Ltd.; Telegraph Construction & Maintenance Co., Ltd.

Bedford.—Electricity Committee. Accepted. Transformer kiosk at Elstow Road (£225) and two kiosks for Cranfield and Clophill (£538).—General Electric Co., Ltd. Two circuit-breakers (£178).—Crompton Parkinson, Ltd.

Birkenhead.—Electricity Committee. Accepted. Transformer (£197).—Brush Electrical Engineering Co., Ltd. Switchgear (£250).—Ferguson, Pailin, Ltd.

Clitheroe.—Accepted. Electric lighting and power plugs in houses on Henthorn Road and Edisford Road housing estates.—Elite Radio Co.

Durham.—County Education Committee. Accepted. Electrical work at Cornforth Lane Council School (£180) and Willington Council School (£226).—R. Robson (Willington).

Harrow.—Fire Brigade Committee. Accepted. Fire alarm installation at fire station (£105).—Standard Telephones & Cables, Ltd.

Leatherhead.—U.D.C. Accepted. Private automatic exchange at Council offices (£204).—Buchanan & Curwen.

Sheffield.—Electricity Committee. Accepted. Sub-station switchgear (£486).—A. Reyrolle & Co., Ltd.

Shipley.—Electricity Committee. Accepted. Two switchgear panels (£523).—English Electric Co., Ltd.

Torquay.—Electricity Committee. Accepted. Fittings for electricity offices and showrooms (£418).—General Electric Co., Ltd.

Forthcoming Events

Royal Institution.—Saturday and Tuesday, January 5th and 8th. Institution, London. Juvenile lectures. "Telegraphs and Telephones" and "Oscillating Electrical Circuits." Prof. W. L. Bragg.

Electrical Power Engineers' Association (*London Local Group*).—Monday, January 7th. Caxton Hall, S.W. 7.15 p.m. "Modern Street Lighting." Mr. W. J. Jones.

Association of Mining Electrical Engineers.—Tuesday, January 8th. Junior Institution of Engineers, London. 6.30 p.m. "Modern Power Station Design and Lay-out." Mr. A. Stubbs. (*Kent Sub-Branch*).—Saturday, January 5th. Technical Institute, Dover. 6.30 p.m. "Low Temperature Carbonisation of Coal." Mr. Brentnall. (*West Wales Branch*).—Saturday, January 5th. Y.M.C.A., Swansea. "Flame-Proof Enclosures." Mr. G. M. Harvey.

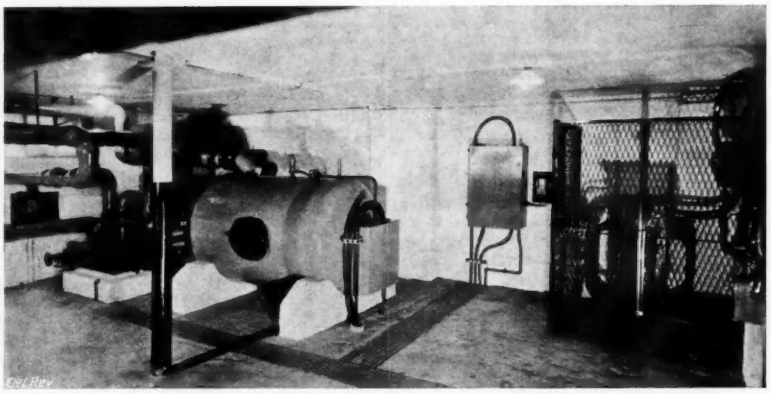
Illuminating Engineering Society.—Tuesday, January 8th. Institution of Mechanical Engineers, London. 7 p.m. "A Cavalcade of Stage Lighting." Mr. L. G. Applebee.

Institution of Heating and Ventilating Engineers.—Wednesday, January 9th. London School of Hygiene and Tropical Medicine, London. 7 p.m. Sessional meeting. "Air Heaters." Mr. A. Fleming Browne.

Institution of Welding Engineers.—Wednesday, January 9th. Institute of Marine Engineers, London. 7.45 p.m. "The Practical Side of Electric Resistance Welding." Mr. H. S. Jeffs. (*Midlands Branch*).—Friday, January 11th. James Watt Memorial Institute, Birmingham. Open discussion on "The Characteristics of Electrodes."

Institution of Electrical Engineers.—Thursday, January 10th. Institution, London. 6 p.m. "Electrical Developments in the U.S.S.R." Mr. A. Monkhouse. (*Meter and Instrument Section*).—Friday, January 4th. Institution, London. 7 p.m. "Cathode-Ray Oscillographs." Papers by Prof. J. I. McGregor-Morris and J. H. Henley, and Dr. S. Parker Smith, Dr. C. E. Szegho and Mr. E. Bradshaw. (*Mersey and North Wales (Liverpool) Centre*).—Monday, January 7th. The University, Liverpool. 7 p.m. Mr. A. Monkhouse's paper. (*North Midland Centre*).—Tuesday, January 8th. Queen's Hotel, Leeds. 7 p.m. "Electrical Warming and Air Conditioning of the Larger Buildings." Messrs. R. Grierson and D. Betts. (*North-Western Centre*).—Tuesday, January 8th. Engineers' Club, Manchester. 7.15 p.m. Mr. A. Monkhouse's paper. (*Scottish Centre*).—Tuesday, January 8th. Engineers' Rooms, Glasgow. 7.30 p.m. Joint meeting with the Institution of Engineers and Shipbuilders in Scotland. "Generation, Distribution and Use of Electricity on Board Ship." Messrs. C. W. Saunders and H. W. Wilson and Dr. R. G. Jakeman. (*South Midland Students' Section*).—Tuesday, January 8th. James Watt Memorial Institute, Birmingham. 7 p.m. Address by Mr. W. Burton. (*Hampshire Sub-Centre*).—Wednesday, January 9th. Municipal College, Portsmouth. 7.30 p.m. "The Electrification of the Manchester South Junction and Altrincham Railway." Lt.-Col. F. A. Cortez Leigh. (*North Midland Students' Section*).—Wednesday, January 9th. Imperial Hotel, Leeds. 8 p.m. Hot-pot supper and entertainment. (*Dundee Sub-Centre*).—Thursday, January 10th. University College, Dundee. 7.30 p.m. "Glass Bulb Mercury Arc Rectifiers." Mr. A. M. Browne. (*North-Eastern Centre Students' Section*).—Friday, January 11th. Armstrong College, Newcastle-upon-Tyne. 7.15 p.m. "Recent Developments in Illumination." Mr. N. H. Denholm.

Bristol Electric Club.—Friday, January 11th. Royal Hotel, Bristol. 8.15 p.m. Address by Mr. A. H. Russell. "Methods of Lighting Calculation."



The heating plant at the Derby Free Library

Notes

The Illuminating Engineering Society

The annual dinner and dance of the Illuminating Engineering Society will be held on February 5th at the Trocadero Restaurant, W.1.

In order to encourage the study of lighting problems among the youth of both sexes, the Council has decided to admit students between the ages of sixteen and twenty-five as "affiliated students" of the Society for a reduced subscription of 10s. 6d. a year. These will have the right to attend meetings, take part in visits, and receive the monthly journal. Forms of application for membership are obtainable from the honorary secretary, Mr. J. S. Dow, 32, Victoria Street, London, S.W.1.

E.P.E.A. Dinner at Cardiff

That the demand for power under the electricity grid scheme would probably exceed the estimates by a wide margin was prophesied last week by Mr. J. W. Beauchamp (manager of the South-West England and South Wales Area of the Central Electricity Board), in replying to the toast of "The Electricity Supply Industry" at the annual dinner of the South Wales Section of the Western Division of the Electrical Power Engineers' Association at Cardiff, with Mr. C. M. Harrison in the chair. Mr. Beauchamp said the control exercised by the Board was of a most benevolent character, and was for the benefit of the industry and more particularly of the great public. It did bring in, however, a new technique. They had had to learn a lot about load despatching, the operation of stations tied together, and had also to seek some phase of new co-operative the slightly Socialistic ideals that they had not had to pursue before. He believed that the success of the system would, if no war or any other untoward convulsion occurred, be much more rapid than the most careful estimates had yet predicted. Other speakers were Ald. A. E. Gough, J.P. (chairman, Cardiff Electricity Committee), Mr. C. Cooper (senior vice-president of the Association), Mr. M. H. W. Mabbett, Mr. A. Nichols Moore (borough electrical engineer, Newport, Mon.), and Mr. Edward Jones (mains engineer, Cardiff).

A Library Heating System

An example of the improvement which can be effected in existing heating installations by means of electricity is given by the new plant installed in the Derby Free Library, particulars of which have been sent us by Mr. F. Nicholls, the Derby borough electrical engineer. The library is a large building consisting in the main of two floors and basement, the ground floor housing the library proper and the first floor the natural history museum. The original method of heating was by a coal boiler and the usual hot-water system, which was mainly 4-in. piping, but as the boiler required renewal, it was decided to use electricity. A storage of 400 gallons of water is provided in order that the plant may be switched off during the station peak period. This in the normal course is very small, but full allowance was made for the large storage in the system itself, which is about 1,200 gallons. The heating plant is placed in the basement and is joined up to the existing pipe-work with some modifications to effect an improvement in the heating as several parts of the building were inadequately served. The supply is 200 V, single-phase, and for this reason it was decided to use resistance-type heaters in the storage rather than follow the usual practice of a separate electrode boiler. In this case the very small capacity of the storage cylinder was taken into consideration; the load is 100 kW. With electric heating it is now possible to effect a good control of the temperature of the building and to maintain it at a constant and equable figure and to arrange so that the building is warm when the library is opened at 9 a.m. Heat is put on to the building a number of hours before opening by means of a time switch.

New Parliamentary Bills

We publish below a list of proposals of an electrical nature that will come forward in the ensuing session of Parliament. Readers who are desirous of obtaining further information will find the notices published in the *London Gazette* for December 4th and 7th.

Stoke-on-Trent, Chichester, Sunderland, Exeter, Harrogate, and Weymouth and Melcombe Regis Corporations, Gelligaer, Beckenham, Rhyl, and Hoylake U.D.C.'s:—Further powers in relation to the respective electricity undertakings.

South Shields Corporation:—Powers with regard to the running of trolley vehicles.

Norwich Electric Tramways Co.:—Abandonment of the tramways; extension of powers of running public service vehicles; to change the name of the company; and for other purposes.

Ascot District Gas & Electricity Co.:—Authority to convert the existing capital of the company; to raise additional capital; and for other purposes.

London Passenger Transport Board:—Powers to provide certain services of trolley vehicles; to construct new works; to acquire lands; to raise additional moneys.

Bognor Gas & Electricity Co.:—A Bill to consolidate with amendments the provisions of the Acts and Orders, 1908 to 1927, relating to the borrowing powers of the company; authority to raise additional money; and to confer further powers.

Folkestone Electricity Supply Co., Ltd.:—Better provision with respect to the rights of the Folkestone Corporation to purchase the undertakings of the company within the borough and the rural district of Elham.

Nottingham Corporation:—To run trolley vehicles on an additional route.

Reading Corporation:—Further powers with regard to trolley vehicles, and the electricity undertaking.

Appointments Vacant

Grade B clerk for Fulham Electricity Department.

Temporary electrical engineering draughtsmen for the Air Ministry.

Meter mechanician for Lichfield Electricity Department.

(See our classified advertisments.)

Makers' Names Wanted

LANGHAM shades.

CHASEWAY d.c. charger.

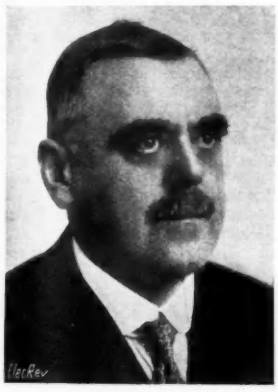
Apparatus for testing the fading propensities of textiles, inks, &c.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

New Year Honours.—We give below the names of the gentlemen with electrical or allied connections whose names were included in the Honours List published on Tuesday last :—

Mr. C. V. Boys, A.R.S.M., LL.D., F.R.S., a past-president of the Physical Society of London, and **Mr. W. L. Stampe,** C.I.E., chief engineer, Irrigation Branch, Public Works Department, United Provinces, receive knighthoods. **Mr. W. Eraut,** M.Inst.C.E., chief engineer, Contracts Branch, Crown Agents for the Colonies, becomes a C.B.E. The O.B.E. has been awarded to **Mr. R. Wheeler,** M.I.E.E., city electrical engineer, Gibraltar; **Mr. F. P. Edgar,** Midland Regional Director, B.B.C.; **Capt. A. J. Mayne,** M.I.E.E., chief electrical engineer, Aldershot Command; and **Mr. R. A. Weaver,** superintending engineer, North Wales District G.P.O. The M.B.E. is given to **Mr. M. A. Higgs,** executive engineer, Public Works Department, Irrigation Branch, United Provinces; **Mr. E. J. W. West,** personal assistant to the chief engineer, Indian Posts and Telegraphs; **Mr. J. L. Henderson,** assistant traffic superintendent (Telegraphs), G.P.O.; **Mr. A. S. Hibberd,** senior announcer, B.B.C.; and **Mr. G. H. Meadmore,** Senior Intelligence Officer, Department of Overseas Trade. **Mr. V. Hart,** chief engineer, Public Works Department, Madras, receives the C.S.I., and **Mr. F. J. Waller,** chief engineer and secretary to the Government of the Punjab, Public Works Department (Irrigation Branch), and **Mr. M. R. Richardson,** officiating chief engineer, Irrigation Branch, Public Works Department, United Provinces, are given the C.I.E.



Mr. A. H. Dykes, J.P.

Mr. A. H. Dykes, M.Inst.C.E., M.I.E.E., the well-known consultant, has been appointed a Justice of the Peace for Bromley. Mr. Dykes has been active in the municipal life of Beckenham for twenty-seven years, having been chairman of the Urban District Council on two occasions. He has been particularly interested in housing questions, and one of the roads on the Council's Shortlands estate has been named after him. He was called in to advise the Bromley Town Council when it had the question of acquiring the local electricity undertaking from the supply company was under consideration.

The principal portions of the paper entitled "The Theoretical and Practical Sensitivities of Gas-focused Cathode-ray Oscillographs, and the Effects of the Gas on their Performance," which is to be read before the Meter and Instrument Section of the Institution of Electrical Engineers in London this evening (January 4th), formed a dissertation approved for the degree of Master of Science (Engineering) in the University of London by **Mr. J. H. Henley,** Graduate I.E.E., joint author of the paper.

Following the death of Mr. A. F. Harris, managing director of Nalder Brothers & Thompson, Ltd., two new appointments have been made. **Mr. A. G. O'Neill,** A.M.I.E.E., who appeared in our photographic group ("Driving Forces," July 8th, 1932) as assistant manager, becomes general manager, and **Mr. A. B. Gibbons,** A.M.I.E.E., who was also described as assistant manager, becomes assistant general manager and

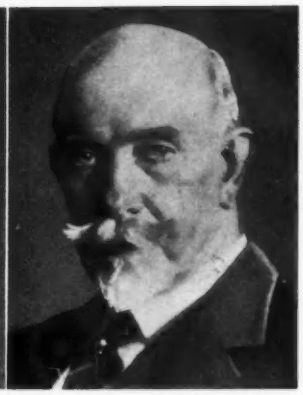
Mr. A. G. O'Neill

Mr. A. B. Gibbons

secretary of the company. Mr. O'Neill, who was educated at Alleyn's, Dulwich, and the Northampton Institute, joined the company as a junior over thirty years ago. He controlled the test room for a number of years. He has taken active committee interest in industrial welfare and the co-operation of educational authorities with Labour. Mr. Gibbons was educated at the South-Western Polytechnic and at the Northampton Institute. He was apprenticed to the company in 1904. In 1919 he was placed in control of the drawing office and estimating departments. On the retirement of Mr. F. H. Nalder, in 1929, Messrs. O'Neill and Gibbons were appointed joint assistants to the managing director. In addition, they have both served for a number of years on technical and commercial committees.

Mr. Sam Mavor announced in the Christmas number of the *M. & C. Apprentices' Magazine* that at the end of December

Mr. J. B. Mavor



Mr. Sam Mavor

he was resigning his position of managing director of Messrs. Mavor & Coulson, Ltd., while retaining the chairmanship. Mr. Mavor is in his seventy-second year and was closely associated with his brother, Mr. H. A. Mavor, who founded the concern fifty-three years ago. Upon the occasion of the company's jubilee in 1931 Mr. Sam Mavor was presented with his portrait in oils, painted by Mr. J. B. Anderson. Our picture of Mr. Mavor was obtained from this portrait. He proposes to take a voyage to South Africa shortly, and upon his return intends to maintain an active interest in the business. He is succeeded by his nephew, Mr. J. B. Mavor, the son of the founder of the firm.

Major Richard Amberton, M.I.E.E., who was one of the founders of the Electrical Apparatus Co., Ltd., and for many years a director, relinquished his connection with that concern at the end of December and is not retaining any interest in it. He has formed a new organisation under the style of Amberton & Partners at 32, Queen Victoria Street, E.C.4, the objects of which are technical and sales development of electricity meters and electric control gear with which he has been so long and so closely identified; on the purely sales side the firm will extend its operations so as to include other supplies. Major Amberton, who was educated at the City of London School, followed the students' course at Schenectady (General Electric Co.), and finished there in the railway department. He returned to England with the intention of specialising in electric traction, but instead, began his connection with the affairs of the Electrical Apparatus Co. In 1913 he invented a motor starter which became the subject of litigation on several occasions but stood its ground successfully. In September, 1914, he was commissioned as an infantry lieutenant, and after being severely wounded on the Somme was retired, retaining the rank of major. He spent the last two years of the war rendering very important service at the Ministry of Munitions (Department of Engineering). After the war he returned to the Electrical Apparatus Co. Many patents for electrical switching, control, measuring and other apparatus were taken out by him from 1919 onwards. He has served on various standardisation and other committees, was prominently associated with the Merchandise Marks application on behalf of British meter manufacturers which was followed by the well-

[Russell & Sons

Major R. Amberton

known Marking Order, and has attended international conferences as one of the representatives of the British meter industry. Major Amberton wrote the booklet on "Power Factor," with which so many of our readers are familiar. His manifold activities of which the above forms but a bare outline, have made him well known in electricity supply circles and he has many friends who will join with us in wishing him success in his new departure.

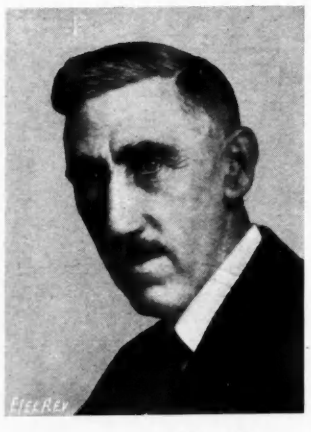
In our last issue we recorded the presentation of a silver inkstand to **Mr. R. P. Sloan,** subscribed to by employés of the North-Eastern Electric Supply Co., Ltd., on the occasion

The presentation to Mr. R. P. Sloan
Seated: Mr. H. A. Couves (general manager and director), and Mr. and Mrs. Sloan. Standing (left to right): Mr. A. G. Shearer (operating superintendent, Northern Area), Col. S. E. Monkhouse (assistant general manager), and Mr. C. Skipsey (secretary)

of his retirement from the managing directorship of the company. We now reproduce, by the courtesy of the *Newcastle Journal*, a photograph of a group taken on that occasion. As we have already stated, Mr. Sloan will remain chairman of the company.

Mr. T. Boardman, B.Sc., A.M.I.E.E., was married on December 15th, at St. Mary's Church, Bearwood, Birmingham, to Miss Dorothy Cox, of Bearwood, Birmingham.

Mr. H. C. Booth, F.C.G.I., M.Inst.C.E., chairman and managing director of the British Vacuum Cleaner & Engineering Co., Ltd., was presented with a silver tea and coffee service by the staff of the company at the annual Christmas revels held at Fulham Town Hall on December 21st. Mr. J. J. Hambidge, general manager, who made the presentation, said this year marked the thirty-third anniversary of the invention of the vacuum cleaner by Mr. Booth, and it was a fitting occasion for the staff to express their regard and affection for him.



[*Elliott & Fry.*

Mr. Frank Gill, who has been elected chairman of the Telephone Development Association for 1935

Mr. W. Hodkinson, of Blackburn, has retired from the G.P.O. telephone Department after thirty-six years' service. He was with the old National Telephone Co.

According to the *Industrial Australian and Mining Standard*, **Mr. J. M. Bridge,** general superintendent at Yallourn, who was appointed in 1920 engineer-in-charge of coal supply and has been associated with the brown-coal open cut from its initial stages, is retiring from the service of the Victorian State Electricity Commission to take a private appointment.

Mr. John Belliss, of Belliss & Morcom, Ltd., of Birmingham arrived in Sydney recently on a visit. The same contemporary reports that **Mr. A. H. Cameron,** chief research engineer in the London Development Laboratories of Standard Telephones & Cables, Ltd., recently took over the management of the Sydney branch of the Company.

Mr. H. Foster Smith, M.C., A.M.I.E.E., the general manager of the Pará Electric Railways and Lighting Co., Ltd., Pará, Brazil, has retired from this position, and has returned to take up work in England. The staff presented him with a gold writing set and his wife received a bag made of native crocodile skin. He leaves behind him many friends amongst the British and Brazilian residents who have been associated with him during his fifteen years' residence in the country.

Mr. F. G. Rogers, whose article on "Resistance Welding" is published on p. 12, is welding engineer and departmental manager to White Metals, Ltd. He was at Faraday House from 1927 to 1931, gaining the college diploma with first-class honours, and he received practical training with Messrs. Fielding & Platt, Ltd., and the Metropolitan-Vickers Electrical Co., Ltd. He is a graduate of the Institution of Electrical Engineers and a member of the Institute of Welding Engineers.

Mr. F. G. Rogers

Mr. H. E. Knight, A.M.I.E.E., chief electrical engineer at Messrs. Stewarts & Lloyds tube works, Corby, was married on December 22nd at St. Peter's Church, Rugby, to Miss Olive Morgan, of Rugby.

Clarence Dock Power Station (Special) Committee of the Liverpool Corporation has recommended the appointment of **Mr. P. J. Robinson** as consulting engineer to the Corporation in connection with the work of construction of the extension to the Clarence Dock power station. It is proposed that the Town Clerk should negotiate with the Central Electricity Board as to the amount which the Board is prepared to pay in respect of fees to be paid to Mr. Robinson and certain members of his staff engaged on this work and that these officials be authorised to retain the remuneration agreed upon.

Obituary

Mr. A. H. Beatty.—The recent death of Mr. Andrew Henry Beatty removes from the City a familiar figure, and from his wide circle of friends a personality who was held in affectionate esteem. One of the original directors of Balfour, Beatty & Co., Ltd., the engineering and contracting firm, and of Power Securities Corporation, Ltd., Mr. Beatty was also chairman of the Llanelly & District Electric Supply Co., Ltd., and a director of several kindred undertakings. He was for the past quarter of a century closely identified with the development of electricity supply, and his business capacity and the shrewdness of his judgment were of great value to this colleagues on the various boards on which he served. Prior to the formation of Balfour, Beatty & Co., Mr. Beatty was secretary of Messrs. J. G. White & Co., Ltd., from 1900 to 1909. For some years he was an officer in the City of London Special Constabulary and for a considerable period a member of the Court of Common Council, representing the Vintry Ward. For his services in the former connection he was made an O.B.E. on his retirement. In his younger days he was an enthusiastic cricketer, and for many years past he had been a regular playing member of various well-known golf clubs. Of a sociable disposition and an excellent raconteur, he was very popular among his fellow members, and many will recall those happy afternoon foursomes which he so much enjoyed.

The late Mr. A. H. Beatty

Mr. A. C. Beer, local secretary of the Victoria Falls & Transvaal Power Co., Ltd., at Johannesburg, has died. Born in London in 1883, he began his career in the railway service, and went to South Africa in 1902. In 1910 he joined the Victoria Falls & Transvaal Power Co., shortly after its formation, and soon after was appointed local secretary.

Prof. G. Vanni.—The death is announced from Rome, at the age of seventy-two years, of Prof. Giuseppe Vanni, the founder, and for many years director, of the Italian Istituto Militare di Radiotelegrafica ed Elettrotecnica.

Mr. N. C. Andersen.—The death occurred on December 8th, at Newcastle, at the age of sixty-two, of Mr. Neils C. Andersen, who, up to his retirement in 1931, was in charge of the instrument room at Newcastle of the Great Northern Telegraph Co. He was connected with the company for thirty-five years.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

H. Ferguson & Co., Ltd.—Private company. Registered December 29th. Capital, £500 in £1 shares. Objects: To acquire that part of the interests and business as relates solely to the business of electrical and chemical engineers carried on by J. R. Bayes and H. C. Williams, as "H. Ferguson & Co.," at 8, Queen's Road, Reading, Berks. The directors are: J. R. Bayes (permanent), 5, Bush Road, Reading, and two others. Secretary: A. Dawes Robinson. Registered office: 6, Queen's Road, Reading.

Rapid Electric Scrubbing Co., Ltd.—Private company. Registered December 18th. Capital, £250 in £1 shares (200 10 per cent. cumulative preference and 50 ordinary). Objects: To carry on the business of manufacturers, hirers and repairers of and dealers in electrical and mechanical apparatus and appliances, &c. The subscribers are: C. A. Brown, Conishead, Ring Road, Leicester (director of A. Brown, Ltd.), and F. H. Tyler, National Chambers, 4, Horsefair Street, Leicester. Secretary: F. H. Tyler.

C. Martin (Engineers), Ltd.—Private company. Registered December 22nd. Capital, £500 in £1 shares. Objects: To carry on the business of mechanical, electrical and motor engineers, &c. The subscribers are: F. Brighty, 223, Stanford Road, S.W.16, and F. H. C. Martin, 83, The Manor Drive, Worcester Park, Surrey. Ernest J. Martin is permanent governing director. Solicitors: Langford, Borrowdale & Thain, 5 & 6, Clements Inn, W.C.2.

Edgware Radio, Ltd.—Private company. Registered December 11th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in gramophones and sound reproducing machines, electric accumulators and batteries and wireless and electrical components and apparatus of all kinds, &c. The first directors are: W. S. Pryor and Grace Pryor, both of 3, Culver Grove, Stanmore, Middlesex. Registered office: 23, Station Road, Edgware.

Nelsons (Supplies), Ltd.—Private company. Registered December 5th. Capital, £400 in £1 shares. Objects: To carry on at 145, Church Street, Blackpool, the business of electrical, mechanical, wireless, telephone, lighting, heating and general engineers, &c. The permanent directors are: G. R. Nelson, 24, Colwyn Avenue, Blackpool, and three others.

Electrical & Household Supplies, Ltd.—Private company. Registered December 21st. Capital, £300 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical goods, apparatus and appliances, accessories, electric lamps, radiators, &c. The permanent directors are: S. H. Williams, 27, Blenheim Road, N. Harrow, Middlesex, electrical engineer; J. H. Ferguson, "Azimuth," Rayners Lane, Pinner; and W. F. Hills, 49, Hardinge Road, Kensal Rise, N.W.10. Solicitor: Wm. C. Strike, 97, Chamberlayne Road, N.W.10.

Kingston-upon-Hull Broadcast Relay Service, Ltd.—Private company. Registered December 28th. Nominal capital, £150,000 in 75,000 6 per cent. cumulative redeemable preference shares of £1 and 300,000 ordinary shares of 5s. Objects: To maintain, take over, install, operate and develop, services for the relaying of radio programmes in any parts of Hull and surrounding districts, and to adopt an agreement with Broadcast Relay Service, Ltd. The directors are: Sir H. B. Grotrian, Bt., K.C., J.P., "Knolls," Leighton Buzzard, Beds, and two others. Secretary (pro tem): W. C. Thornton Cran. Registered office: Bush House, Aldwych, W.C.2.

Cahier's Electrical Vibrator Co., Ltd.—Private company. Registered December 22nd. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in mechanically operated massaging machines, &c. C. G. E. Cahier, 31, Alfred Place, S.W.7, is permanent director. Registered office: 31, Alfred Place, S.W.7.

Returns of Electrical Companies

Streamlite Electric Lamp Co., Ltd.—Debenture, dated December 13th, 1934, to secure £1,500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: S. L. Kaphan, 8, Kingsley Close, Hampstead Garden Suburb, N.W.

Magna Wire & Cable Co., Ltd.—Capital, £11,000 in 10,000 preference shares of £1 and 20,000 ordinary shares of 1s. Return dated November 27th, 1934. 2,027 preference and 11,500 ordinary shares taken up. £2,027 paid on the preference shares, £575 considered as paid on the ordinary shares. Mortgages and charges nil.

Hewittic Electric Co., Ltd.—Capital, £50,000 in £1 shares. Return dated July 12th, 1934. 40,000 shares taken up. £40,000 paid. Mortgages and charges nil.

West Devon Electric Supply Co., Ltd.—Capital, £250,000 in 100,000 preference and 150,000 ordinary shares of £1 each. Return dated June 21st, 1934. All shares taken up. £186,513 paid on 88,000 preference and 98,513 ordinary shares, £63,487 considered as paid on the remainder. Mortgages and charges nil.

J. W. Ray & Co. (Liverpool), Ltd.—Capital, £3,000 in £1 shares. Return dated September 25th, 1934. 2,753 shares taken up. £2,753 paid. Mortgages and charges nil.

T. H. Satchwell, Ltd.—Capital, £3,000 in £1 shares. Return dated September 26th, 1934. 2,502 shares taken up. £1,252 paid, £1,250 considered as paid. Mortgages and charges nil.

Watliff Co., Ltd.—Capital, £10,000 in 3,000 ordinary and 7,000 preference shares of £1. Return dated October 2nd, 1934. 3,000 ordinary and 6,100 preference shares taken up. £3,980 paid on 2,880 ordinary and 6,100 preference shares, £120 considered as paid on 120 ordinary shares. Mortgages and charges: £4,500.

Parmiter, Hope & Sugden, Ltd.—Debenture dated November 30th, 1934, to secure £15,000 charged on the company's undertaking and property, present and future, including uncalled and unpaid capital, subject to mortgage dated August 15th, 1922. Further charge dated May 10th, 1922, and charge dated July 6th, 1931. Holders: County Bank, Ltd.

City of London Electric Lighting Co., Ltd.—Satisfaction in full on January 1st, 1934, of trust deed dated January 8th, 1902, and registered January 16th, 1934, securing £400,000 second debenture stock. (Notice filed December 19th, 1934.)

Erinoid, Ltd.—The nominal capital has been increased by the addition of £55,000 beyond the registered capital of £275,000. The additional capital is divided into 55,000 redeemable 6 per cent. cumulative preference shares of £1 each.

City Notes

Ruston & Hornsby, Ltd., are to repay their 6 per cent. debentures, of which £250,000 is outstanding, on June 30th next. The stock is redeemable at par. It is proposed to create a 4½ per cent. debenture stock and holders of the 6 per cent. debentures may exchange the whole or part of their holdings for an equal amount of the new stock. Unchanged holdings will be paid off on June 30th. The new stock will be redeemable at par on January 1st, 1975, but the company reserves the right of redemption at par on or after January 1st, 1965.

Boulton & Paul, Ltd.—Presiding at the annual meeting on December 28th, Mr. J. D. Paul (chairman), in the course of his speech, referred to the reorganisation of the company and said that in addition to dealing with the aircraft department and the reorganisation of the structural steel shop, it had been necessary to dispose of their smaller interests in the foundry and the country house electric lighting and pump departments, leaving as their future activities woodworking, galvanised wire netting, and structural steelwork.

The General Electric Co., Ltd., has notified holders of its 4½ per cent. first mortgage debenture stock that the company will redeem on March 31st next the whole of the balance of the stock then outstanding at 110 per cent., together with interest (less tax) to March 31st, after which date interest will cease to accrue. This stock was issued in March, 1933, £1,054,900 for cash at 105 and £2,445,100 in conversion of 5 per cent. stock. Of the total of £3,500,000, the amount outstanding is £3,482,000. The company proposes to increase its capital to £9,600,000 by the creation of 2,000,000 ordinary shares of £1 each. The major portion of the new capital will be used to redeem the debenture stock. This will leave at the disposal of the company an adequate amount of unissued capital to be issued if and when opportunities may arise for developing its business. An extraordinary meeting to authorise the increase of capital will be held on January 10th.

The Rushden and District Electric Supply Co., Ltd., intends to pay off on July 1st next the whole of the 5 per cent. debenture stock at the rate of £102 10s. for every £100 stock. The usual half-year's payment of interest on the stock will be made on July 1st.

The Altrincham Electric Supply, Ltd., has declared a dividend of 3s. 9 3/5d. per share on the participating ordinary shares and 1s. 3 6/7d. per share on the deferred shares (unchanged).

Marconi's Wireless Telegraph Co., Ltd., has announced a final dividend on the 7 per cent. cumulative participating preference shares (1s. 4.8d. per share, less tax, net 1s. 1.02d.).

The Great Northern Telegraph Co. has declared the usual second interim dividend of 2½ per cent.

Stocks and Shares

NEW YEAR'S DAY.

THE year 1934 will stand out, it is reasonable to suppose, as having for one of its principal features the extraordinary fashion in which prices have gone ahead of all Stock Exchange securities that have an investment flavour. There have been many ups and downs in the other markets. Industrials and mining shares played leading parts from time to time in attracting the interest of the public. The underlying factor, however, which influences practically everything else, has been the cheapness of money and the difficulty of employing available capital to advantage. The further lowering of interest rates as a sequel to the financial happenings at home and abroad, has made investment a difficult problem for the average capitalist, large or small, to whom the rate of interest he or she receives on the money is a matter of real importance.

The year 1934 finished with prices almost at the top, in so far as these concern gilt-edged investment stocks and shares. It is true that some of the ordinary shares in the Industrial list stood below the prices at which they started the twelvemonth. The issues of the various public boards—Central Electricity, London & Home Counties, and West Midlands Joint Authority stocks—show considerable strength. London Passenger Transport "C" stock has justified the favourable anticipations of those who, when the price stood 20 points lower, saw in it the possibility of appreciation. The various new issues made from time to time by undertakings interested in the distribution, &c., of electricity, have been readily taken, and without exception. The price of the 3½ per cent. War Loan concluded the year at practically a record figure.

Central Electricity 3½ per cents at 102 are up 9 points. Transport C stock at 100 goes against 84 a year ago. The other issues in this section have gained 4 or 5 points.

London Electricity Supply

In the list of ordinary shares of the London electricity supply companies, it will be noticed that the average price which obtained at the end of 1933—that is to say, about 34s.—has been succeeded by an average of nearer 36s. 3d. The whole of the list moved up upon registration of a small company, the object of which is to bind together, through working agreements, a number of London electricity supply concerns. This step was assumed to imply a probable reduction in expenses, with the natural corollary of increased dividends. The distributions for the year 1934 have yet to be announced, but it is hoped that to the previously paid 7 per cent. there may be added an extra 10s. per cent. dividend for the year just ended. The announcements will be made in the usual way about February. The following representative prices in this particular group give comparisons of the year's net fluctuations :—

Ordinary shares.	Dec. 30, 1932.	Dec. 30, 1933.	Dec. 31, 1934.	Rise.
Brompton	33/6	34/–	36/–	2/–
Charing Cross	33/6	34/6	36/–	1/6
Chelsea	33/–	34/–	36/–	2/–
City of London	34/–	35/–	38/6	3/6
County of London	50/–	56/3	57/–	9d.
Kensington	33/6	34/6	36/–	1/6
Metropolitan	47/–	53/9	54/6	9d.
St. James & Pall Mall	33/6	34/6	38/6	4/–
South London	33/–	34/6	36/–	1/6
Westminster	33/–	34/6	36/6	2/–

In the list of ordinary shares in the provincial electricity supply companies, the changes are comparatively unimportant. The statistics give an idea of the way in which prices moved during the twelvemonth :—

Ordinary shares.	Dec. 30, 1932.	Dec. 30, 1933.	Dec. 31, 1934.	Rise or Fall.
Bournemouth & Poole	70/6	78/3	78/9	+6d.
Clyde Valley	32/–	41/3	41/6	+3d.
Elec. Dis. Yorkshire	41/3	47/6	50/–	+2/6
Lancs Light & Power	29/3	35/–	38/6	+3/6
Midland Counties	33/3	38/9	38/6	–3d.
Midland Elec. Power	34/6	45/–	47/6	+2/6
Newcastle-on-Tyne (North Eastern)	28/–	35/6	33/6	–2/–
Northampton	48/9	55/–	57/6	+2/6
Scottish Power	33/9	41/3	43/–	+1/9
Yorkshire Elec.	39/–	47/6	48/–	+6d.

Cables and Wireless

A rise of 9½ points in Cables & Wireless preference indicates, as clearly as anything can do, the trend of speculative investment. The public are not buying purely gambling stocks to the same extent as they are speculatively investing their money in such securities as Cables & Wireless preference. On this last-named stock the dividend of 2¾ per cent. has been repeated this year—just half, of course, of the rate to which the stock is entitled. The recent traffics have been a little disappointing, but not sufficiently so to stop the absorption of the stock by the purchaser who looks two or three years ahead. The "A" and the "B" are, however, decidedly lower. The prices of Globe Telegraph & Trusts have moved in accordance with the fluctuations in Cables & Wireless preference. American Telephone & Telegraph shares show 3 points fall in the year. Marconi Marines are a few shillings higher. This group compares the current prices with those obtaining at the end of 1932, as well as 1933 :—

Stock or share.	Dec. 30, 1932.	Dec. 30, 1933.	Dec. 31, 1934.	Rise or Fall.
American Tel. & Tel.	155½	109⅛	106½	–3
Anglo-American pref.	106½	114	122	+8
Cables & Wireless pref.	77½	73⅛	83	+9⅞
Cables & Wireless "A"	27	23	18½	–4½
Cables & Wireless "B"	12	10½	7	–3½
Globe ordinary	10⅜	10	11½	+1½
Great Northern	27½	32½	38	+5½
International Tel & Tel.	11	12½	8⅜	–3⅛
Marconi Marine	32/–	30/–	33/9	+3/9

Manufacturing and Equipment

From the spectacular point of view British Electric Traction deferred stock is the "star turn," having exactly doubled the 450 at which the price stood at the end of 1933. The preferred ordinary put on 21 points during the year. The manufacturing companies' shares are generally better, as the following list illustrates. Brush ordinary is an exception, with a fall of 2; Ever Ready is another, the shares being lower, on activity of competition :—

Ordinary shares.	Dec. 30, 1932.	Dec. 30, 1933.	Dec. 31, 1934.	Rise.
Babcock & Wilcox	40/–	40/–	45/–	5/–
British Aluminium	23/–	27/3	28/9	1/6
British Insulated	3¼	3⅜	77/–	4/6
Callender's	3⅛	3 3/16	3 5/16	¼
Enfield Cables	4 7/16	4⅜	4 13/16	7/16
G.E.C.	38/9	42/6	50/–	8/–
Henleys	6 1/16	6⅛	6 13/16	11/16
Johnson & Phillips	20/–	18/9	28/3	9/6
Siemens	25/–	20/–	20/–	—

Miscellaneous Matters

Victoria Falls ordinary at 7½ are 30s. to the good. Mexican issues are mostly lower : Brazilian Tractions record a loss of ⅛. Of the British iron and steel shares, Babcock & Wilcox make a good showing. The rubber share market spurted in the summer, but came back again as the produce dwindled in price. Business in the Stock Exchange during the year now ended has been well maintained in a number of markets. Prospects for the present New Year are cheerful. Stock Exchange markets are active and their prices, as a whole, are very firm. The financial outlook can be truthfully described as healthy.

Share List of Electrical Companies

	Nom.	Dividend. 1932.	Dividend. 1933.	Price. Dec. 31.	Rise or Fall.	Yield. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	78/9	—	3 16 2
Brompton Ordinary	1	7	7	36/–	—	3 17 9
Charing Cross Ordinary	1	7	7	36/–	—	3 17 9
Chelsea	1	7	7	36/–	—	3 17 9
City of London	1	7½	7½	38/6	—	3 18 0
Clyde Valley	1	7	7	41/6	+6d.	3 7 6
County of London	1	10½	10½	57/–	–6d.	3 13 8
Edmundson's 7% Pref.	1	7	7	37/-xd.	—	3 15 8
Elec. Dis. Yorkshire	1	9	9	50/–	+6d.	3 12 0
Elec. Supply Corporation	1	11	11	58/3	–6d.	3 15 7
Kensington Ordinary	1	7	7	36/–	—	3 17 9
Lancs Light and Power	1	7	7½	38/6	—	3 18 0
London Electric	1	7	7	37/–	—	3 15 8
Metropolitan	1	10	10	54/6	+6d.	3 13 7
Midland Counties	1	7	7	38/6	—	3 12 9
Mid. Elec. Power	1	8	8	47/6	—	3 7 7
North Eastern Electric Ordinary	1	6	6	33/6	—	3 11 7
Do. 7% Pref.	1	7	7	35/6	—	3 19 0
Northampton	1	10	10	57/6	+⅛	3 9 6
Notting Hill 6% Pref.	10	6	6	14½	—	4 4 4
North Met. Elec. Ordinary	1	10	10	64/6	+1/–	3 2 6
Do. do. 6% Pref.	1	6	6	32/6	—	3 13 10
St. James' and Pall Mall	1	7	7½	38/6	—	3 18 0
Scottish Power	1	8	8	43/–	+6d.	3 14 5
South London	1	7	7	36/–	—	3 17 9
Westminster Ordinary	1	7	7	36/6	—	3 16 9
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	22/6	+1/–	6 13 4
Yorkshire Elec.	1	8	8	48/–	—	3 6 8
PUBLIC BOARDS.						
Central Electricity, 1950–70	Stock	5	5	117	+1	4 5 6
Do. 1955–75	,,	5	5	119	+1	4 4 0
Do. 1951–73	,,	4½	4½	110	—	4 1 10
Do. 1963–93	,,	—	3½	102	—	3 8 8
London & Home Counties, 1955–75	,,	4½	4½	115	—	3 18 3
London Passenger Transport, A	,,	—	4½	124½	+1	3 12 4
Do. do. B	,,	—	5	127½	—	3 18 5
Do. do. C	,,	—	3	100	+5	3 0 0
West Midlands Joint Elec. 1948–68	,,	—	5	118	—	4 4 9
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$100	9	9	106½	–2	8 9 0
Anglo-Am. Tel. Pref.	Stock	6	6	122	—	4 18 4
Do. Def.	,,	1½	1½	31	–½	4 16 9
Cables & Wireless 5½% Pref.	,,	2¾	2¾	83	—	3 6 3
Do. A. 7½% Ord.	,,	Nil	Nil	18½	—	—
Do. B. Ord.	,,	Nil	Nil	7	—	—
Globe Tel. and T. Ord.	10	Nil	2½	11½	+⅛	2 4 5
Do. do. Pref.	10	6	6	13⅜	—	4 8 0
Great Northern Tel.	10	20	20	38	—	5 5 3
Marconi-Marine	1	10	7½	33/9	—	4 9 0
Oriental Telephone Ord.	1	12	12	3½	—	*3 13 10
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	1/6	—	—
Do. do. 2nd Pref.	5	Nil	Nil	1/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	,,	5	5	900	–15	—
Do. do. Pref. Ord.	,,	8	8	168½	—	4 15 0
Brazil Traction	100	—	—	10⅞	+⅛	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	108	—	4 12 7
Mexico Trams, 5% Bonds	—	5	5	19½	—	—
Mexican Light Common	100	Nil	Nil	3½	—	—
Do. 7% Pref.	100	7	7	4½	—	—
Do. 1st Bonds	—	5	5	45	—	—
Victoria Falls Ord.	1	15	20	7½	+½	2 16 2
Yorkshire (West Riding)	1	2½	5	26/3	—	3 16 2
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	10	10	70/–	+⅛	2 17 2
Assoc. Elec. Ord.	1	4	3	24/6	—	2 9 0
Do. Prf.	1	8	8	36/3	+⅛	4 8 3
Babcock & Wilcox	1	9	6	45/–	—	2 13 4
British Aluminium Ord.	1	5	5	28/9	—	3 9 7
British Insulated Ord.	1	15	15	77/–	—	3 18 0
Brush Ord.	Stock	Nil	Nil	38	—	—
Callender's	1	15	15	3⅛	—	4 10 6
Do. 6½% Pref.	1	6½	6½	32/6xd.	+6d.	4 0 0
Crompton Parkinson Ord.	5/–	22½	12½	36/–	—	1 14 10
Do. 8% Pref.	1	8	8	35/–	—	4 11 5
Edison-Swan 1st Pref.	1	7½	7½	23/9	—	6 6 4
Electric Construction	1	Nil	Nil	15/–	–⅛	—
Enfield Cable Ord.	1	25	20	4 13/16	—	4 3 0
English Electric	1	Nil	Nil	7/6	—	—
Do. do. Pref.	1	Nil	Nil	11/3	—	—
Ever Ready	5/–	35	35	23/6	+1/9	7 9 0
Ferranti Pref.	1	7	7	30/–	–9d.	4 13 4
G.E.C. Pref.	1	6½	6½	32/6	—	4 0 0
Do. Ord.	1	8	8	50/–	—	3 4 0
Henley's	1	30	30	6 13/16	—	4 8 0
Do. 4½% Pref.	5	4½	4½	5⅛	+⅛	3 16 8
India-Rubber Preferred	1	—	—	1 1/16	—	—
Johnson & Phillips	1	5	5	28/3	–6d.	3 10 10
Siemens Ord.	1	6½	4	1	—	4 0 0
Telegraph Construction	£1	Nil	Nil	1 1/16	—	—

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parenthesis are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

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6382. "Moving iron oscillographs." L. H. Matthews and E. C. M. d'Assis-Fonseca. March 2nd, 1933. (420517.)

9791. "Electrical two-way amplifiers." Telefonaktiebolaget L. M. Ericsson. August 5th, 1932. (Cognate application 9792/33.) (420595.)

9914. "Cathode-ray tubes for television purposes." Radioakt.-Ges. D. S. Loewe and K. Schlesinger. April 4th, 1932. (Cognate applications 25274/34, 25275/34, and 25276/34.) (420667.)

10497. "Vacuum electric tube devices or valves." E. Y. Robinson and Associated Electrical Industries, Ltd. April 7th, 1933. (420745.)

10614. "Control of low-pressure gas or vapour-filled electric discharge devices." Akt.-Ges. Brown Boveri et Cie. April 8th, 1932. (Addition to 409331.) (420808.)

10729. "Electric condensers." Muirhead & Co., Ltd., J. V. Foll and H. J. Marshall. April 10th, 1933. (420809.)

13250. "Wireless direction-finding systems." Marconi's Wireless Telegraph Co., Ltd., H. M. Dowsett, and L. E. Q. Walker. May 6th, 1933. (420669.)

15598. "Electric measuring instruments." International General Electric Co., Inc. May 31st, 1932. (420819.)

15913. "Telephone systems." Telefonaktiebolaget L. M. Ericsson. June 3rd, 1932. (420607.)

16155. "Method of and arrangement for the synchronisation of television receiving apparatus." Radioakt.-Ges. D. S. Loewe and K. Schlesinger. June 7th, 1932. (420679.)

16156. "Braun tube." Radioakt.-Ges. D. S. Loewe and B. Wienecke. June 8th, 1932. (420538.)

16157. "Television arrangement including a Braun tube." Dr. E. Hudec. June 6th, 1932. (Cognate application 16158/33.) (420752.)

16222. "Electron-discharge tubes for generating and receiving ultra-short waves." O. Heil. June 16th, 1932. (420681.)

16223. "Electron-discharge tubes for the production or amplification of short waves." O. Heil. June 16th, 1932. (420753.)

16269. "Thermionic apparatus for the production or amplification of ultra-short waves." Telefunken Ges. für Drahtlose Telegraphie. June 4th, 1932. (420754.)

16270. "Superheterodyne receivers." Telefunken Ges. für Drahtlose Telegraphie. June 4th, 1932. (420685.)

16271. "Thermionic valves." Telefunken Ges. für Drahtlose Telegraphie. June 4th, 1932. (420686.)

16272. "Frequency modulating arrangements." Telefunken Ges. für Drahtlose Telegraphie. June 4th, 1932. (420687.)

16486. "Thermionic oscillation generators." Marconi's Wireless Telegraph Co., Ltd., and T. D. Parkin. June 8th, 1933. (420830.)

16505. "Radiogoniometers and like devices." H. Fitzherbert and J. F. Coales. June 9th, 1933. (420832.)

18372. "Electric incandescent lamps." L. F. De Backer. February 2nd, 1933. (420841.)

18672. "Safety switching device for ignition circuits of engine and other circuits." J. Gonnard. July 18th, 1932. (420540.)

19181. "Electrical heating apparatus." G. H. Collins and H. F. Collins. July 6th, 1933. (420761.)

19818. "Electric testing instruments, more particularly for testing thermionic valves and measuring resistances." F. Rooke. July 13th, 1933. (420762.)

20781. "Holders and sockets for electric incandescent lamps." A. Fischesser. July 24th, 1933. (420613.)

21613. "Electrical socket contacts." C. L. Arnold and M.K. Electric, Ltd. August 1st, 1933. (420700.)

21961. "Thermionic valves." F. Schuetz and V. Tomberg. August 4th, 1933. (420546.)

22182. "Systems of electric motor control." British Thomson-Houston Co., Ltd. August 6th, 1932. (420547.)

24009. "Electric lampholders." J. A. Crabtree. August 30th, 1933. (Addition to 405023.) (Cognate application 29832/33.) (420849.)

24623. "Electrically operated thermal relays." General Railway Signal Co. September 20th, 1932. (420766.)

25072. "Transformer power regulation." H. R. Watson, R. F. Gilson and R. B. Gilson. September 11th, 1933. (420767.)

26381. "Leading-in conductors sealed through the vitreous envelopes of electrical devices." General Electric Co., Ltd., and V. J. Francis. September 25th, 1933. (420618.)

26458. "Fuses for electric circuits." G. Ellison and J. Anderson. September 26th, 1933. (420619.)

28310. "Automatic or semi-automatic telephone systems." Ericsson Telephones, Ltd., and D. C. Crowe. October 13th, 1933. (420622.)

28892. "Flexible electric cables." Pirelli-General Cable Works, Ltd., and J. L. Bishop. October 18th, 1933. (Cognate application 24269/34.) (420714.)

29730. "Electric bells." Siemens Bros. & Co., Ltd., and E. R. Wigan. October 26th, 1933. (420549.)

31899. "Dynamo-electric machines." C. M. Pestarini. November 15th, 1933. (420770.)

33218. "Vacuum or low-pressure gas or vapour apparatus for electric discharges." Elin Akt.-Ges. für Elektrische Industrie. November 26th, 1932. (Cognate application 33219/33.) (420724.)

34273. "Television and like systems." Fernseh Akt.-Ges. December 6th, 1932. (420727.)

34613. "Method of making incandescent filaments for electric incandescent lamps or discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. January 11th, 1933. (420854.)

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248. "Illuminated circuit diagrams for facilitating the supervision of electrical power or other distribution installations." Siemens & Halske Akt.-Ges. August 10th, 1933. (Cognate application 249/34.) (420629.)

1216. "Manufacture of electric condensers." Siemens & Halske Akt.-Ges. January 12th, 1933. (420774.)

1905. "Electric bells." J. W. Dungey. January 19th, 1934. (420557.)

2769. "Sound emitting apparatus." Naamlooze Vennootschap Machinerieen-en Apparaten Fabrieken. June 15th, 1933. (420558.)

3139. "Electric discharge tubes." General Electric Co., Ltd. February 22nd, 1933. (420634.)

5773. "Clasp or fastening for storage batteries." Etablissements E. Esswein. February 21st, 1933. (420735.)

6040. "Apparatus for impregnating electric cables." Naamlooze Vennootschap Machinerieen-en Apparaten Fabrieken. March 2nd, 1933. (420863.)

9567. "Cable terminals or clamps for storage and other batteries." G. E. Liljekvist. May 15th, 1933. (420568.)

9729. "Electromagnetic means for transmitting and receiving signals between a point on a railway line and a train travelling thereon." S. Citterio and P. Vacchina. April 15th, 1933. (420740.)

10111. "Thermionic valves and other electron-discharge devices and methods of manufacturing the same." Telefunken Ges. für Drahtlose Telegraphie. April 3rd, 1933. (420645.)

10133. "Electric torches." Batterien-und Elemente-Fabrik System Zeiler Akt.-Ges. March 31st, 1933. (Cognate application 10134/34.) (420780.)

10201. "Illuminated signs." F. G. Lucas and Brilliant Sign Co. (1907), Ltd. April 4th, 1934. (420870.)

11306. "Electric hot-plates." J. Juul. April 14th, 1934. (420569.)

11319. "Electric lamps and the like." British Thomson-Houston Co., Ltd. April 15th, 1933. (420783.)

11573. "Clips for connecting electrical conductors with connecting members particularly for sparking plugs of internal-combustion engines." Fabbrica Italiana Magneti Marelli. April 18th, 1933. (420570.)

12513. "Electrical transmission systems for multiple-carrier frequency currents." Siemens & Halske Akt.-Ges. May 18th, 1933. (420571.)

13160. "Tubular electric incandescent lamps." General Electric Co., Ltd. July 13th, 1933. (420788.)

13588. "Automatic volume-control systems in radio reception and the like." E. Y. Robinson and Associated Electrical Industries, Ltd. April 7th, 1933. (Divided application on 420745.) (420789.)

14247. "Vapour or gaseous electric discharge devices." Westinghouse Electric & Manufacturing Co. May 27th, 1933. (420872.)

14304. "Permanent-magnet systems, especially brake magnets for electric meters." British Thomson-Houston Co., Ltd. May 13th, 1933. (420791.)

14814. "Radio and other modulated carrier-wave transmitters."Marconi's Wireless Telegraph Co., Ltd. May 17th, 1933. (420574.)

15664. "Electric gasfilled incandescent lamps." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 10th, 1933. (420575.)

15993. "Mercury-arc devices." English Electric Co., Ltd. August 17th, 1933. (420576.)

17402. "Automatic circuit-breakers." J. T. Shevlin (Siemens Schuckertwerke Akt.-Ges.). June 12th, 1934. (420653.)

17993. "Apparatus for producing straight-line motion, more particularly for electric switchgear." English Electric Co., Ltd., and A. A. Heath. June 18th, 1934. (420656.)

18359. "Braun tube." Radioakt-Ges. D. S. Loewe and K. Schlesinger. March 10th, 1932. (Divided application on 7117/33.) (420876.)

18422. "Filling of gasfilled electric incandescent lamps." Soc. Anon. pour les Applications de l'Electricité et des Gaz Rares. Etablissements Claude-Paz et Silva. April 23rd, 1934. (420877.)

21373. "Electric radiators." H. Frost & Co., Ltd., and A. W. Moss. July 21st, 1934. (420798.)

22383. "Earth clips for electrical conductors and wireless uses." G. Scott, J. Griffiths and H. Freestone." August 1st, 1934. (Addition to 3216/34.) (420662.)

23072. "Electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 11th, 1933. (420586.)

23255. "Prevention of sparking in the control of electric circuits." British Thomson-Houston Co., Ltd. August 12th, 1933. (420587.)

25279. "Television arrangements with cathode-ray tubes." Radioakt-Ges. D. S. Loewe and K. Schlesinger. January 12th, 1933. (Divided application on 420667.) (420881.)

25287. "Linen pounder with bell operated by an electric motor." P. Schulz. September 3rd, 1934. (420882.)

26666. "Luminous electric discharge tubes." General Electric Co., Ltd. September 26th, 1933. (420663.)

327088. "Installation of metallic-vapour rectifiers having glass containers." British Thomson-Houston Co., Ltd. September 21st, 1933. (420803.)

27870. "Protective circuit-breakers." Felten & Guilleaume Carlswerk Akt.-Ges. October 24th, 1933. (420590.)

29500. "Apparatus for medical treatment with electrical oscillations of very high frequency." Siemens & Halske Akt.-Ges. March 1st, 1933. (Addition to 419136.) (Divided application on 419136.) (420805.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 26th:—

Gilbarco. No. 548740. Class 8. Temperature and pressure controlling and regulating instruments and apparatus.—Gilbert & Barber Manufacturing Co., West Springfield, Mass., U.S.A. (British representatives: Barker, Brettell & Duncan, 75-77, Col more Row, Birmingham.)

Clarivol. No. 554877. Class 8. Radio-telephonic and telegraphic instruments.—H. D. Milburn, Ltd., 81, Darlington Road, Wolverhampton.

Prento. No. 546546. Class 13. Electrical switches (ordinary). —Herbert B. Prentice, Progress Works, Gelderd Road, Leeds, 12.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Baths (£90,000); T. F. Henderson, city engineer. R.C. school, Nelson Street, for E.C.; A. B. Gardner, city architect, 11, Broad Street.

Abergele.—Municipal offices, Chester-Holyhead Road; R. O. Roberts, surveyor, Town Hall.

Abergele & Pensarn.—Houses (50); U.D.C. surveyor.

Aberystwyth.—Extensions to county schools (£9,440), for the governors; clerk.

Airdrie.—Houses (208), and public baths, Stirling Street (£12,000); Jn. K. Fraser, burgh surveyor, Royal Buildings.

Alnwick.—Houses (24); R.D.C. surveyor.

Altrincham.—Bank, Broadheath, for Union Bank of Manchester, Ltd., York Street; T. A. Fitton & Son, architects, 19a, Corporation Street.

Ayr.—Extension to Berkley Hotel, Barns Street (£8,500); E. Farmer, proprietor.

Barking.—Factory, Ripple Road; Universal Soap Co., Ltd.

Bath.—Extensions to City of Bath Girls' School, for E.C.; A. J. Taylor, architect.

Bexhill-on-Sea.—Houses (30), London Road; borough surveyor.

Birmingham.—Cinema, New Street, for Odeon Cinema Circuit.

Blackburn.—Extensions to Salisbury Mill, Nuttall Street, for British Cotton and Wool Dyers' Association, Ltd., Cumberland Street, Manchester; Woof Cronshaw & Co., Ltd., builders, Pump Street.

Blackpool.—Shops and houses, Moor Park Avenue; T. Brierley.

Blaydon-on-Tyne.—Houses (44), Chopwell; T. V. Mastaglio, U.D.C. surveyor, Council Offices.

Bolton.—Extensions to Isolation Hospital, Hulton Lane; borough engineer. Extensions to St. Thomas's School, Halliwell; Church of England trustees.

Bootle.—Houses (110), Aintree Road; borough engineer.

Bournemouth.—Houses, Kinson, and Strouden; borough engineer.

Bridlington.—Concert hall (£26,000), electrical work; P. M. Newton, borough architect.

Buckinghamshire.—Boys' grammar school, Slough, for County E.C.; C. H. Riley, county architect, Aylesbury.

Burnham-on-Crouch.—Bank, High Street, for Barclays Bank, Ltd., London.

Burnley.—School, Myrtle Bank, for Borough E.C.; director of education.

Bury St. Edmunds.—Municipal offices, Angel Hill; borough surveyor.

Chelmsford.—Reconstruction of Agricultural Institute (£100,000); county architect.

Chertsey.—Houses (38), Burwood House site; Percy Bilton (Roadway), Ltd.

Chesterfield.—Houses (54), Grassmoor; W. Drabble & Sons, Ltd., Mosborough, near Sheffield.

Chester-le-Street.—Houses (150), for aged persons; M. Wilson, Council Offices.

Chichester.—Post office and telephone exchange, West Street, for H.M. Office of Works, King Charles Street, London, S.W.

Chigwell (ESSSEX).—Church, Grange Hill; A. Thomerson, architect.

Clay Cross.—Secondary school (£24,441); C. E. Gaunt, builder, Chesterfield.

Coatbridge.—Houses (152), Calder Street; J. Spence, burgh surveyor, Municipal Buildings.

Consett.—Houses (76), Moorside; J. J. Ettringham, surveyor, Derwent Street, Blackhill.

Coventry.—Houses (67), Radford Estate (£31,490); city engineer.

Cramlington.—Houses (50); W. Coulson, surveyor, Council Offices.

Cuckfield.—Extensions, including new block, bathrooms, additions to administrative block, and reconstruction of laundry, Isolation Hospital; R.D.C. surveyor.

Dalbeattie.—Houses (28), Craigmath; Purdon Smith, architect.

Darfield (YORKS).—Houses (70), Barnsley Road; U.D.C. surveyor.

Daventry.—Houses (68); R.D.C. surveyor.

Derbyshire.—Elementary school, Frenchville, near Brighton; county architect.

Devizes.—Swimming bath (£3,500); borough surveyor.

Doncaster.—Houses (73); F. O. Kirby, borough engineer, 2, Priory Place.

Dukinfield.—Houses, "A" type (£89,250); E. N. Stannion, borough surveyor, Town Hall.

Dunmow.—Head post office, for H.M. Office of Works, King Charles Street, London, S.W.

Dunoon.—Houses (28), Bleck Park (£10,000); W. Rodger, burgh surveyor, Burgh Buildings.

Durham.—Senior schools, Wheatley Hill, for County E.C.; F. Willey, county architect, 34, Old Elvet.

East Elloe (LINCOLNSHIRE).—Houses (48), Holbeach; A. E. Palmer, architect, 1a, Pinchbeck Street, Spalding.

Edinburgh.—Houses (994); city architect.

Enfield.—Houses (200), Broadlands Estate; Hilberry Chaplin, Ltd. Houses (97), Hertford Road and Bullsmoor Lane; C. E. Owen Ward. Houses (38), Parsonage Lane; W. Goodchild & Co. Indoor swimming bath; U.D.C. surveyor.

Essex.—Schools, Hornchurch (£35,500), Dagenham, and treatment centre Grays, for County E.C.; J. Stuart, county architect, Chelmsford.

Eston (YORKS).—Houses (292), and bungalows; U.D.C. surveyor.

Fleetwood.—Improvement and modernisation of fishing port (£85,000); L.M. & S. Railway Co.

Girvan.—Houses (70), Bourtreehall; burgh surveyor.

Glasgow.—Houses (72), Berryknowes Road, Hillington, for the housing department; Housing Department, 20, Trongate.

Gloucester.—Civic centre (£200,000); E. Vincent Harris, architect.

Golborne.—Houses (141) and shops, Golborne Road; Rowland Thomasson, architect, 87, Moseley Street, Manchester.

Harrow.—Isolation hospital, Rayners Lane; U.D.C. surveyor.

Hartley Wintney.—Houses (26); Pool & Sons, builders.

Hoylake.—Houses (50); U.D.C. surveyor.

Hull.—Extensions to City Hospital, including cubicle and admission blocks and operating theatre; city engineer.

Ilford.—Houses (379), Barley Lane Estate; G. F. Siegerts. Houses (24), Falmouth Gardens; P. G. Ashton & Sons. Houses (54), Heybridge Drive; South Essex Property Co., Ltd. Houses (30), Leyswood Drive, &c.; J. W. Lohden. Shops, flats, &c., Longbridge Road, Breamore Road and Goodmayes Lane; H. W. Binns. Houses (222), Longwood Gardens, Rushden Gardens, &c.; Hilberry Chaplin, Ltd.

Keighley (YORKSHIRE).—Houses (72) and bungalows, Woodhouse Estate; Ernest Turner, Ltd., builders, Bradford Street.

Kenilworth.—Houses (30), Dalehouse Lane; E. Shaw, U.D.C. surveyor.

Kingston-on-Thames.—Block of flats, Villiers Road (electrical work); R. G. Tarran, Ltd., builders, Hull. School, Latchmere Lane (£13,787) for Borough E.C.; B. G. E. Harper, secretary.

Lancashire.—Schools, Accrington, and extensions to Radcliffe Technical School for County E.C.; director of education, Preston.

Leicester.—Additions, College of Art and Technology (£65,750), and extensions to Domestic Science Centre (£39,970), for E.C.

Leicestershire.—Primary schools, Griffydam, Ashby-de-la-Zouch, for County E.C.; director of education, Leicester.

Luton.—Houses (35), Limbury Road, for A. J. Colbourn, builder.

Merthyr Tydfil.—Library (£8,732); E. Williams & Son, builders, Dowlais.

Mexborough.—Houses (100), Windhill Estate, Hirst Gate; Oscar Weaver, builder, Mexborough.

Middlesbrough.—Houses (134), Kader Farm Estate, for W. Brunton.

Midlothian.—Houses (50) for Midlothian C.C.; county clerk, Edinburgh.

Morecambe.—Development of Woodhill Estate; Wm. Gardner & Co., Ltd.

Nailsworth (GLOS).—Houses (20); T. Wood, U.D.C. surveyor.

Neath.—Senior schools, Wellfield, for E.C.; director of education.

Newcastle-on-Tyne.—Extensions to hospitals during the next three years (£68,000); J. W. Steele, city engineer.

Newton Abbot.—Houses (32), Broadlands; Carpenter & Mayne.

Norton-on-Tees.—Houses (24), Beverley Road; H. Stubbing, builder.

Peterborough.—Swimming pool and central bus station; Major E. M. Stirling, consulting engineer, 8, Station Chambers.

Ponders End.—Houses (28), Alma Road; Melhuish & Henson. Houses (40), Falcon Field Estate; L. Raymond.

Rawtenstall.—Extensions to Glen works, Ashworth Street; W. Spender & Son, Ltd.

Rochdale.—Houses (140), Kenyon Fold, Bamford, near Heywood; R. & T. Howarth, builders, Crossfield Works.

Romsey.—Houses (68); W. H. Bryant, builder, Gardener's Lane.

Ross-on-Wye.—Houses (42), Tudorville Estate; Wilesmith & Son, Malvern Link.

Salford.—Senior school, Broughton, for City E.C.; P. Howard, architect, Mosley Street, Manchester.

Sauchie (CLACKMANNAN).—Houses (48), Sprotwell; Offices, County Buildings, Alloa.

Shipley.—Houses (31), Glenfield Estate; J. & P. Obank. Houses (120), West Royds site, and two schools, Wrose Road and Windhill; U.D.C. surveyor. Development of Victoria Park Farm Estate; H. Chippindale.

Skipton (YORKSHIRE).—Swimming bath and slipper baths; U.D.C. surveyor, Town Hall.

Slough.—Municipal offices and assembly hall (£48,000); C. H. James & S. Rowland Pierce, architects.

Smethwick.—Factory, Oldbury Road; Alberta Manufacturing Co.

Southend-on-Sea.—Houses (122), Leigh Estate; Henry Boot & Sons, Ltd., builders.

South Shields.—Houses (148), Wenlock Road; G. Bailey, Ltd., builders. Rebuilding of the Empire Theatre; E. M. Lawson, architect, 19, Ridley Place, Newcastle-on-Tyne. Rebuilding Stanhope Road School (£30,000); F. W. Newby, architect, 57, King Street.

Sutton Coldfield.—Houses (107), Oakwood Road; E. Alec Coleman.

Wakefield.—Houses (110), Warmfield; W. E. Massie, Council's surveyor, 18, St. John's Street, North.

Wallasey.—Development of Dale Hey Estate; J. McGeoch & Sons. Estate development of Pine Tree Grove, Moreton; Mr. Edwards.

Watford.—Flats and houses, Water Lane; W. W. Newman, borough engineer.

Wellington.—Houses (50), Hadley; R.D.C. surveyor.

Welwyn Garden City.—Houses (78); G. R. Barnsley, architect. Houses (50) for the employés of De Havilland Aircraft Co., Ltd., Stag Lane, Edgware, London.

West Ham.—Trade school for girls, Stratford College (£20,000); borough surveyor.

West Suffolk.—Girls' secondary school, Sudbury (£17,000), for County E.C.; county architect, Bury St. Edmunds.